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## Moab Project

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# Environmental Air Monitoring Sampling and Analysis Plan

March 2003



Prepared for U.S. Department of Energy Grand Junction Office  
under DOE Contract Number DE-AC13-02GJ79491.  
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Sampling and Analysis Plan**

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U.S. Department of Energy  
Grand Junction Office  
Grand Junction, Colorado

Work Performed Under DOE Contract Number DE-AC13-02GJ79491

## Contents

Abbreviations and Acronyms .....	v
1.0 Introduction .....	1
1.1 Site Location .....	1
1.2 Site History .....	4
1.3 Climatology .....	4
1.4 Previous Investigations .....	5
1.4.1 Radioparticulates .....	5
1.4.2 Radon and Direct Gamma .....	5
1.4.3 Meteorology .....	5
2.0 Basis for Sampling .....	6
3.0 Objectives .....	6
4.0 Field Sampling Procedures .....	8
4.1 Airborne Radioparticulates .....	8
4.2 Radon .....	8
4.3 Direct Gamma .....	11
4.4 Meteorological Monitoring .....	11
4.5 Opacity .....	12
4.6 Responsibilities .....	12
5.0 Analytical Procedures .....	12
6.0 Quality Assurance and Quality Control .....	13
6.1 Sample Control .....	14
6.2 Records and Document Control .....	14
6.3 Sampler Calibration and Flow Checks .....	15
6.4 Analytical Laboratory QA/Quality Control .....	15
7.0 Data Review and Reporting .....	15
8.0 Health and Safety .....	16
9.0 References .....	16

## Figures

Figure 1. Area Location Map for the Moab Project Site .....	2
Figure 2. Site Features Map for the Moab Project Site .....	3
Figure 3. On-Site Air Quality Monitoring Locations .....	9
Figure 4. Off-Site Background Air Monitoring Locations .....	10

## Tables

Table 1. Public Dose Limits and Air Quality Standards/Guidelines for the Moab Project Site .....	7
Table 2. Reporting Limits and Analytical Methods .....	13
Table 3. Dose/Concentration Sensitivities for Analytical Parameters .....	13

## **Appendices–Field Sampling Procedures**

Sampling for Airborne Radioparticulates Using a Low-Volume Continuous Air Sampler

GJO–Standard Practice for Quality Assurance (GA–3[P])

GJO–Standard Practice for Health and Safety (GA–4[P])

GJO–Standard Practice for Field Documentation Processes (GT–1[P])

GJO–Standard practice for Chain-of-Sample-Custody Control and  
Physical Security of Samples (GT–3[P])

Chem-Nuclear Geotech, Inc.–Standard Test Method for Exterior Radon Measurements  
Using Alpha-Track Monitors (GS–13[T])

## Abbreviations and Acronyms

CFR	Code of Federal Regulations
cm	centimeters
DOE	U.S. Department of Energy
°C	degrees Celsius
°F	degrees Fahrenheit
hr	hour
km	kilometers
MEI	maximally exposed individual
NPS	National Park Service
NRC	Nuclear Regulatory Commission
PwC	PriceWaterhouse Coopers
SAP	Sampling and Analysis Plan
TLDs	thermo luminescent detectors
U.A.C.	Utah Administrative Code
UMTRCA	Uranium Mill Tailings Radiation Control Act
URC	Uranium Reduction Company

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## 1.0 Introduction

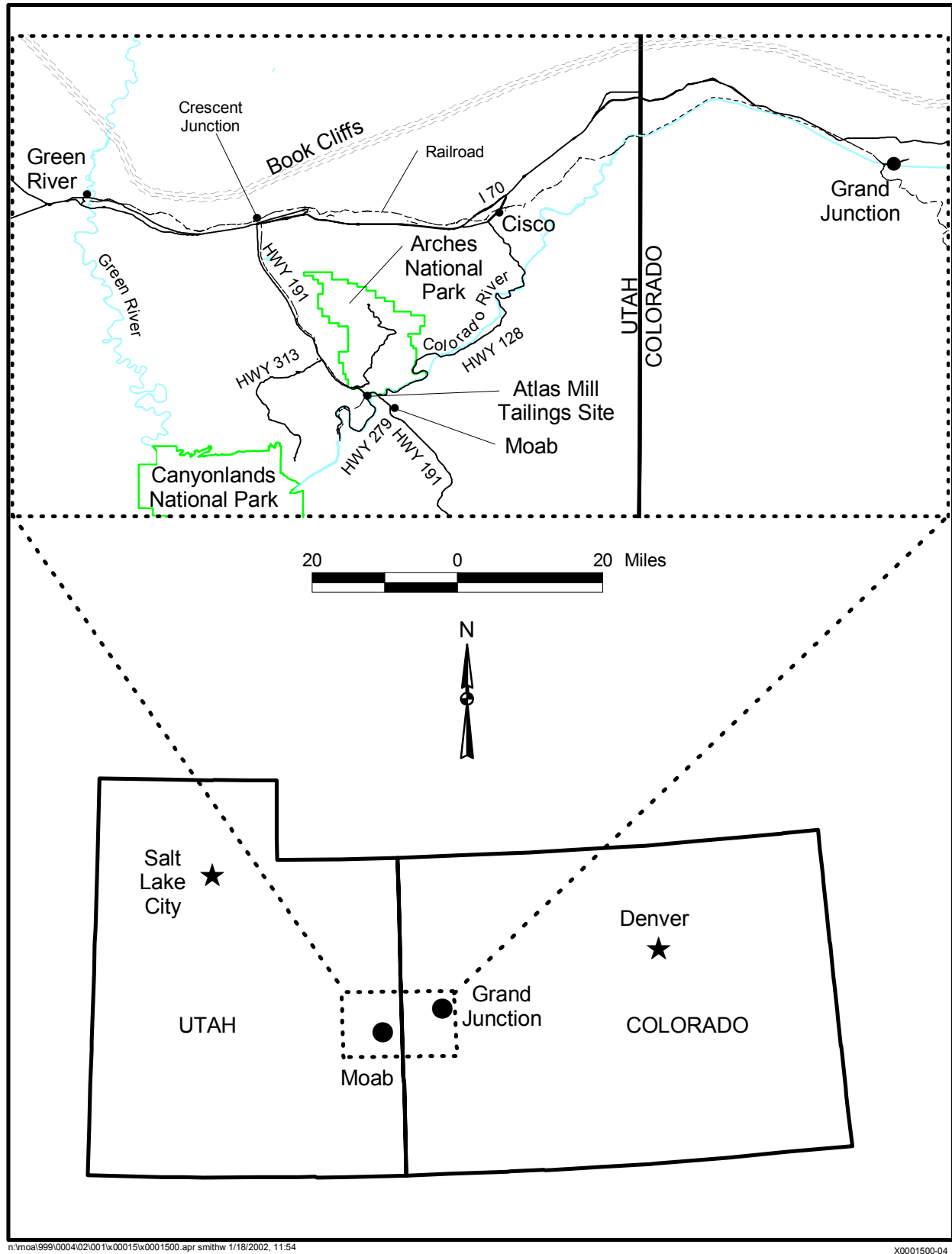
This sampling and analysis plan (SAP) describes the environmental air monitoring activities to be conducted at the former Atlas Mill Tailings Site (Moab Project Site) located in Moab, Utah. Air monitoring at this site will consist of sampling airborne radioparticulates, radon, and direct gamma radiation at various locations along the site perimeter, at various off-site locations in the surrounding community, and at selected background locations. Data collected from these monitoring activities will be used to determine the radiological exposure conditions at the site boundary, and the resulting doses to members of the public. As appropriate, opacity conditions at the site property boundary will also be monitored.

Environmental air monitoring at the Moab Project Site is conducted to assess compliance with U.S. Department of Energy (DOE) Orders, and Federal and State air regulations. DOE Order 5400.1, *General Environmental Protection Program*, specifies that effluent monitoring and environmental surveillance be conducted to determine the effect of DOE activities upon "...on-site and offsite environmental and natural resources," and to "...verify compliance with applicable Federal, State, and local effluent regulations and DOE Orders." Public dose limits are defined by DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, and the Utah Administrative Code, Section R313–15–301. The *Environmental Regulatory Guide for Radiologic Effluent Monitoring and Environmental Surveillance* (DOE 1991), hereafter referred to as the DOE Regulatory Guide, recommends identifying and monitoring diffuse sources such as tailings piles. National primary and secondary air quality standards (codified at 40 CFR, Part 50) define maximum acceptable levels of particulate matter necessary to protect public health. The Utah Administrative Code (U.A.C.), Section R446–1–4.5, specifies that fugitive emissions must not exceed 20 percent opacity.

### 1.1 Site Location

The Moab Project Site is a former uranium-ore-processing facility located approximately 3 miles northwest of the city of Moab in Grand County, Utah ([Figure 1](#)).

The Moab Project Site is irregularly shaped; a uranium mill tailings pile occupies much of the western portion of the site. The Moab Project Site is bordered on the north and southwest by steep sandstone cliffs. The Colorado River forms the southeastern boundary of the site. U.S. Highway 191 parallels the northern site boundary, and State Highway 279 parallels the southwestern boundary. Arches National Park is located adjacent to the northern site boundary, and Canyonlands National Park is located approximately 12 miles to the southwest. The Union Pacific Railroad traverses a small section of the site just west of Highway 279, then enters a tunnel and emerges several miles to the southwest. Moab Wash runs in a southeasterly direction through the center of the site and joins with the Colorado River. The wash is an ephemeral stream that flows only after precipitation or during snowmelt. The entire site covers approximately 435 acres of which 130 acres are covered by the tailings pile. [Figure 2](#) shows the major physiographic features of the Moab Project Site.



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Figure 1. Area Location Map for the Moab Project Site

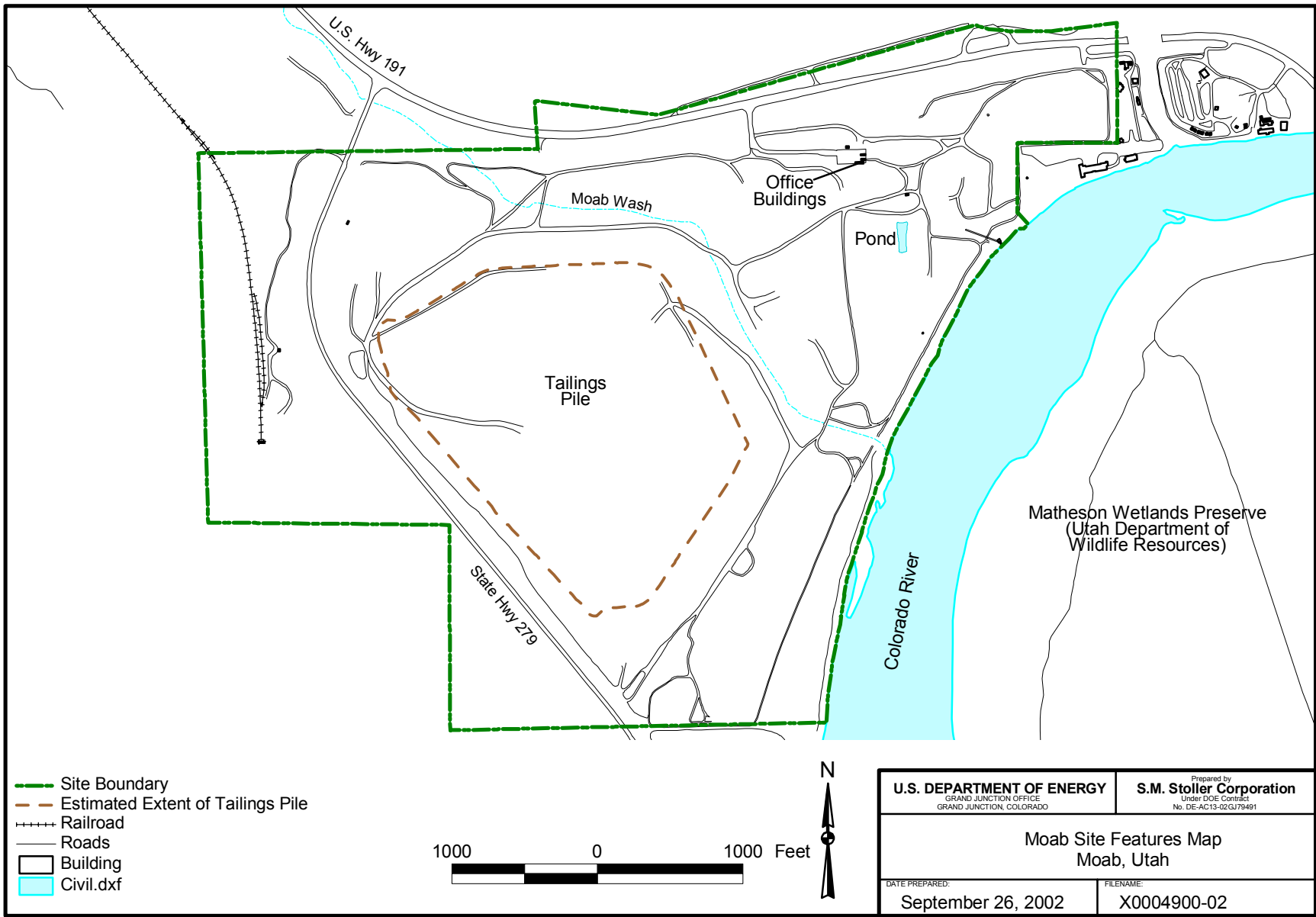


Figure 2. Site Features Map for the Moab Project Site

## 1.2 Site History

Originally, the property and facility were owned by the Uranium Reduction Company (URC) and were regulated by the Atomic Energy Commission, predecessor agency to DOE. In 1956, URC began operation of the Moab mill. In 1962, the Atlas Minerals Corporation acquired URC and operated the mill until operations ceased in 1984. Between 1956 and 1984, uranium mill tailings were disposed of on site in an unlined impoundment. Decommissioning of the mill began in 1988; between 1989 and 1995, an interim cover was placed on the tailings impoundment. In 1996, Atlas proposed to reclaim the tailings pile for permanent disposal in its current location. However, Atlas declared bankruptcy in 1998, and subsequently, the U.S. Nuclear Regulatory Commission (NRC) appointed Pricewaterhouse Coopers (PwC) as the trustee of the Moab reclamation trust and licensee for the site.

Stakeholders have expressed concern about the effects of contaminants from the site on the Colorado River. These stakeholders include local citizens, Utah officials, environmental groups and agencies, as well as downstream water users of the Colorado River. Responsibility for remediation of the Moab Project Site was effectively transferred from PwC to DOE by passage of the Floyd D. Spence National Defense Authorization Act (H.R. 5408, 2001). This act further designates that the Moab Project Site undergo remediation in accordance with Title I of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA; 42 U.S.C. 7912).

## 1.3 Climatology

The climate of the Moab region is semiarid. The average annual temperature is approximately 14 degrees Celsius (°C) (57 degrees Fahrenheit [°F]). January is the coldest month, averaging -1°C (30°F), and July is the warmest month, averaging 28°C (82°F). Extreme temperatures have ranged from -28°C (-18°F) in January 1963 to 44°C (111°F), which has occurred more than once (in July 1953 and on earlier occasions). Temperatures of 32°C (90°F) or higher occur about 100 days per year, with about 80 percent of those occurring during June, July, and August. Temperatures below freezing 0°C (32°F) occur on the average of 123 days of the year with about 80 percent of those occurring during November through February. The effects of high temperature on human comfort are moderated by the low relative humidity, which is often less than 50 percent during the daytime hours.

Average annual precipitation at Moab is 20 centimeters (cm) (8 inches), distributed approximately equally among the seasons with slight peaks during the spring and fall. Potential evapotranspiration (about 127 cm [50 inches] per year) greatly exceeds annual precipitation. Mean pan evaporation (about 140 cm [55 inches] per year) and lake evaporation (about 97 cm [38 inches] per year) also greatly exceed the total annual precipitation.

Low humidity in the region limits fog occurrences (visibility less than 0.5 kilometer [km] [0.3 mi]) to fewer than 10 days per year. Thunderstorms occur about 40 days per year. Hail occurs approximately 3 days per year.

Wind data that are representative of actual wind conditions at the Moab Project Site are sparse and inconclusive. Based upon interviews with local residents near the site, and long time site workers, the prevailing wind direction at the Moab Project Site is presumed to be southeasterly. In an effort to better understand actual meteorological and climatological conditions at the Moab

Project Site, DOE installed a meteorological monitoring station in July 2002, and initiated the collection of various meteorological data (including wind speed and direction). As sufficient data are collected, this SAP will be updated to reflect any changes in the presumed wind directions, and to accurately report average, minimum/maximum, and standard deviations of wind speed as observed at the site.

## **1.4 Previous Investigations**

### **1.4.1 Radioparticulates**

Radioparticulate air monitoring has been conducted at the Moab Project Site since approximately 1979. Historically, Atlas personnel operated five low-volume continuous air samplers. Three of the air samplers were located on-site, and two samplers were located off-site (i.e., background sampling locations). Samples were analyzed for thorium-230, radium-226, and total uranium. Analytical data were used to compile semi-annual effluent monitoring reports as required by 10 Code of Federal Regulations (CFR) Part 40.65, *Effluent Monitoring Reporting Requirements*.

### **1.4.2 Radon and Direct Gamma**

Radon monitoring also has been conducted at the Moab Project Site since approximately 1979. Radon canisters (similar to alpha sensitive Radtrack detectors) were co-located at the five air particulate monitoring stations (both on- and off-site locations), as well as on the eastern fence line (in the northeastern corner of the site property) where the maximally exposed individual (MEI) resides. The resulting data were used to determine radon exposures to the MEI. The MEI represents the closest location to the site boundary that is occupied by a member of the public on a continual basis. Typically, the MEI location also represents a worst-case exposure scenario. Analytical data also were reported in the semi-annual *Effluent Monitoring Report* as required by 10 CFR 40.65.

Environmental gamma radiation monitoring also has been conducted at the Moab Project Site since approximately 1979. Environmental gamma radiation has been monitored using thermoluminescent dosimeters (TLDs). Environmental gamma radiation monitoring locations were co-located at each of the air particulate monitoring locations. The resulting analytical data are used to determine the cumulative radiological exposure at the site boundary.

### **1.4.3 Meteorology**

Atlas maintained a meteorological monitoring station at the Moab Project Site until 1984, when the mill ceased operations. Monitoring data from the Atlas meteorological monitoring station have been lost over the years and are not available. The National Park Service (NPS) operates limited assortment of meteorological monitoring equipment at the entrance to Arches National Park (located approximately 0.25 mile northeast of the entrance to the Moab Project Site off of State Highway 191). Because the Arches NPS weather station is the closest source of meteorological data for the Moab Project Site, wind speed and direction data collected at the NPS Arches Entrance was used as the basis for establishing preliminary air, radon, and direct gamma monitoring locations. DOE has installed a meteorological monitoring station at the Moab Project Site to characterize atmospheric dispersion conditions, which may be used for calculating the dose of radiological contaminants to the general public (DOE 1991).

## 2.0 Basis for Sampling

Radionuclides of concern at this site include uranium (total), thorium-230, polonium-210, and radium-226. These contaminants are constituents of uranium mill tailings and have the potential to become airborne. Once airborne, these radioparticulates are susceptible to natural climatologic forces and may be dispersed and transported away from their source (i.e., the Moab Project Site). Radon-222, a gas produced by the decay of the radioactive isotopes associated with uranium mill tailings, is also a radionuclide of concern at the Moab Project Site. Inhalation of these airborne radioparticulates and radon (and its progeny) are the primary sources for radiological impacts to both the MEI and to the general population surrounding the Moab Project Site. Because many of the radionuclides associated with uranium mill tailings are gamma emitters, direct gamma measurements will also be collected to quantify cumulative gamma exposure conditions. As required by DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, dose rates from all radionuclides will be summed annually to determine average annual exposures.

To determine the radiological impacts resulting from exposure to these contaminants, DOE will conduct environmental air monitoring at various locations along the site perimeter and at representative receptor locations within the community to determine the actual exposure/dose to members of the public and to the environment. Background data for these same parameters must also be collected in order to quantify actual emissions from the Moab Project Site.

## 3.0 Objectives

The primary objective of this SAP is to monitor and document existing/current ambient air quality and radiological exposure conditions at the Moab Project Site. Specific objectives of this SAP are:

- 1) To verify compliance with applicable environmental air quality standards and public radiological exposure limits (see [Table 1](#)); and to fulfill the environmental monitoring and surveillance requirements of DOE Orders 5400.1 and 5400.5;
- 2) To establish a baseline of air quality conditions at the Moab Project Site, and at various other off-site and background locations;
- 3) To measure off-site concentrations of airborne radioparticulates, radon, and direct gamma radiation. Off-site dose levels are monitored so that preventative measures can be initiated before the dose limits are exceeded;
- 4) To detect and quantify any unplanned release from the site; and,
- 5) To verify the effectiveness and accuracy of models used to predict the concentrations of pollutants in the environment.

These objectives may change as the level of activity (i.e., construction activity, earth moving, land disturbance, etc.) changes at the Moab Project Site. With the occurrence of any major construction activity, DOE may initiate additional monitoring to comply with air quality regulations applicable to that activity.

The public dose limits and air quality standards/guidelines applicable to the Moab Project Site are summarized in Table 1.

*Table 1. Public Dose Limits and Air Quality Standards/Guidelines for the Moab Project Site*

Parameter	Regulatory Citation	Standard / Limit / Guideline	Frequency of Collection / Analysis
Derived Concentration Guides - DCGs <sup>1</sup> (Radioparticulates: Ra-226, Th-230, Po-210, and total Uranium)	DOE Orders 5400.5	Ra-226: 1.E-12 Th-230: 4.E-14 Po-210: 1.E-12 U-Nat: 2.E-12	Filters collected weekly; composited and submitted for analysis monthly.
Direct Gamma Radiation (e.g., TLDs)	DOE Order 5400.5 and U.A.C. R313–15–301	100 mrem/yr + background	TLDs collected and analyzed quarterly.
Atmospheric Radon (e.g., Track Etch radon cup)	DOE Order 5400.5 (Chapter III, Figure III-3)	3.0 pCi/L + background	Radon cups collected and analyzed quarterly.
Fugitive Dust Emissions / Opacity	U.A.C. R307–205–6 U.A.C. R307–309	20 %	Dust emissions and opacity will be monitored continuously and controlled as needed.

<sup>1</sup>The DCG represents the concentration that would cause a member of the public, residing at the point of collection, to receive a dose of 100 mrem/year from a specific radionuclide.

In determining an appropriate limit for atmospheric radon emissions at the MPS, it is recognized that the radon standard as promulgated in the UMTRCA regulations (i.e., 40 CFR 192.02) is a design standard that is intended to be applied to radon emissions from the cover of an engineered disposal cell that provides for the long-term containment of residual radioactive material (RRM). Accordingly, this radon standard is *not* applicable to the MPS, because the RRM at the Moab site is not currently contained within a long-term disposal cell and covered/protected by an engineered cover (including radon barrier).

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, establishes standards and requirements for operations of DOE and DOE contractors with respect to protection of members of the public and environment against undue risk from radiation.

Chapter II of the order sets public dose limits for members of the public at 100 mrem/year from DOE radiation sources. The order excludes contributions from radon in the dose limit. Chapter III (Figure III-3) provides a concentration in air limit of 3.0 pCi/L at the site boundary per DOE Order 5400.5.

In the absence of a federal environmental radon *standard* that is directly applicable to the MPS site and its current condition, DOE's goal for atmospheric radon emissions at the site boundary and any offsite locations is that such emissions should not exceed 3 pCi/L plus background (annual average radon concentration). Also, it should be recognized that this radon goal is not an enforceable environmental standard, rather it is a self-imposed guideline, the applicability of which should be periodically evaluated as additional monitoring data are collected.

## 4.0 Field Sampling Procedures

### 4.1 Airborne Radioparticulates

Due to the lack of available historical meteorological monitoring data for the Moab Project Site, assumptions have been made as to the prevailing wind directions for the purposes of establishing air particulate and radon/gamma radiation monitoring locations. The prevailing wind direction is believed to be northwest to southeast; therefore, continuous air samplers monitoring radioparticulate emissions will be biased along the southeastern property line. The monitoring network is designed to provide exposure data for both the MEI and the closest population center, the city of Moab, both located downwind of the Moab Project Site. The radioparticulate monitoring network consists of nine continuous air samplers: two on-site locations in the northeastern corner of the Moab Project Site property ([Figure 3](#)), and seven off-site radioparticulate sampling locations as shown in [Figure 4](#).

The designated background monitoring locations (0117 and 0122) comply with the siting recommendations as outlined in DOE's *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991). The topographic (e.g., elevation) and geologic characteristics of the background monitoring locations are similar to those found at the Moab Project Site. Both background locations are sited a sufficient distance away from the Moab tailings pile that windblown contaminants transported off site are diluted by natural dispersion and will not influence background or ambient air quality measurements.

Radioparticulate samplers are RADeCO Model AVS–28A low-volume, constant flow air samplers, or the equivalent. Each sampler runs continuously at a rate of 60 liters per minute. Filters are collected and replaced once a week. To obtain average monthly values of radioparticulate concentrations, weekly filter samples will be composited and analyzed as one sample. Filter collection will be performed in accordance with the attached GJO Field Sampling Procedure, *Sampling for Airborne Radioparticulates Using a Low-Volume Air Sampler* ([Appendix A](#)), and with DOE's *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991). Field data will be collected and maintained in a field logbook (see [Appendix A](#)).

### 4.2 Radon

As shown in [Figures 3 and 4](#), the radon monitoring network consists of sixteen on-site locations and eight off-site locations. Thirteen of the sixteen on-site locations are placed on or near the actual property boundary; the remaining three on-site locations are located on top of the tailings pile. Radon is also monitored at the nearest occupied residential structure (i.e., the care takers house for Tex's River Tours) closest to the mill site property. This location represents the MEI and is located immediately adjacent to the eastern boundary of the mill site property ([Figure 3](#)). With exception to the MEI location, all off-site radon monitoring locations are co-located with each offsite radioparticulate monitoring locations (see [Section 4.1](#)).

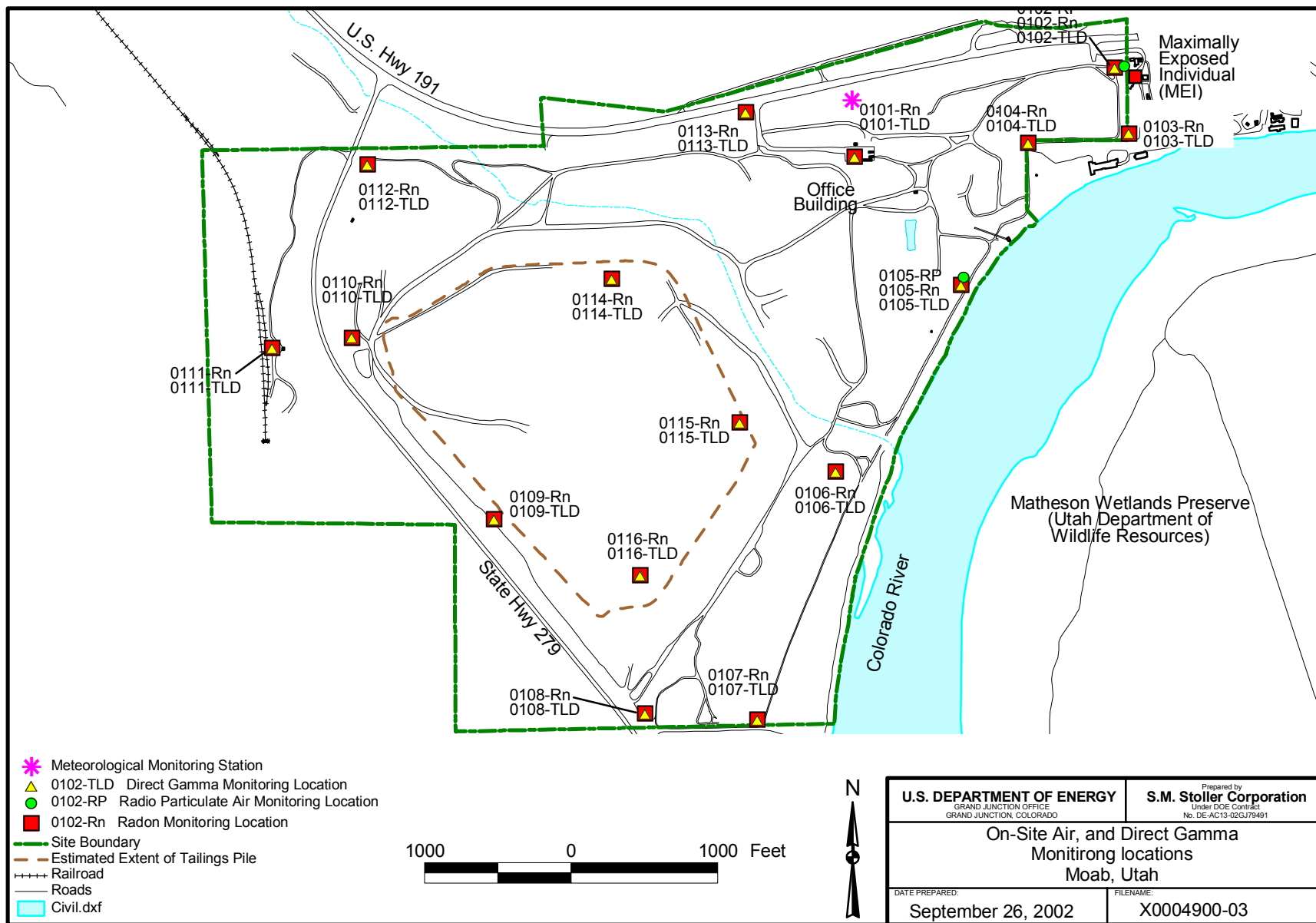


Figure 3. On-Site Air Quality Monitoring Locations

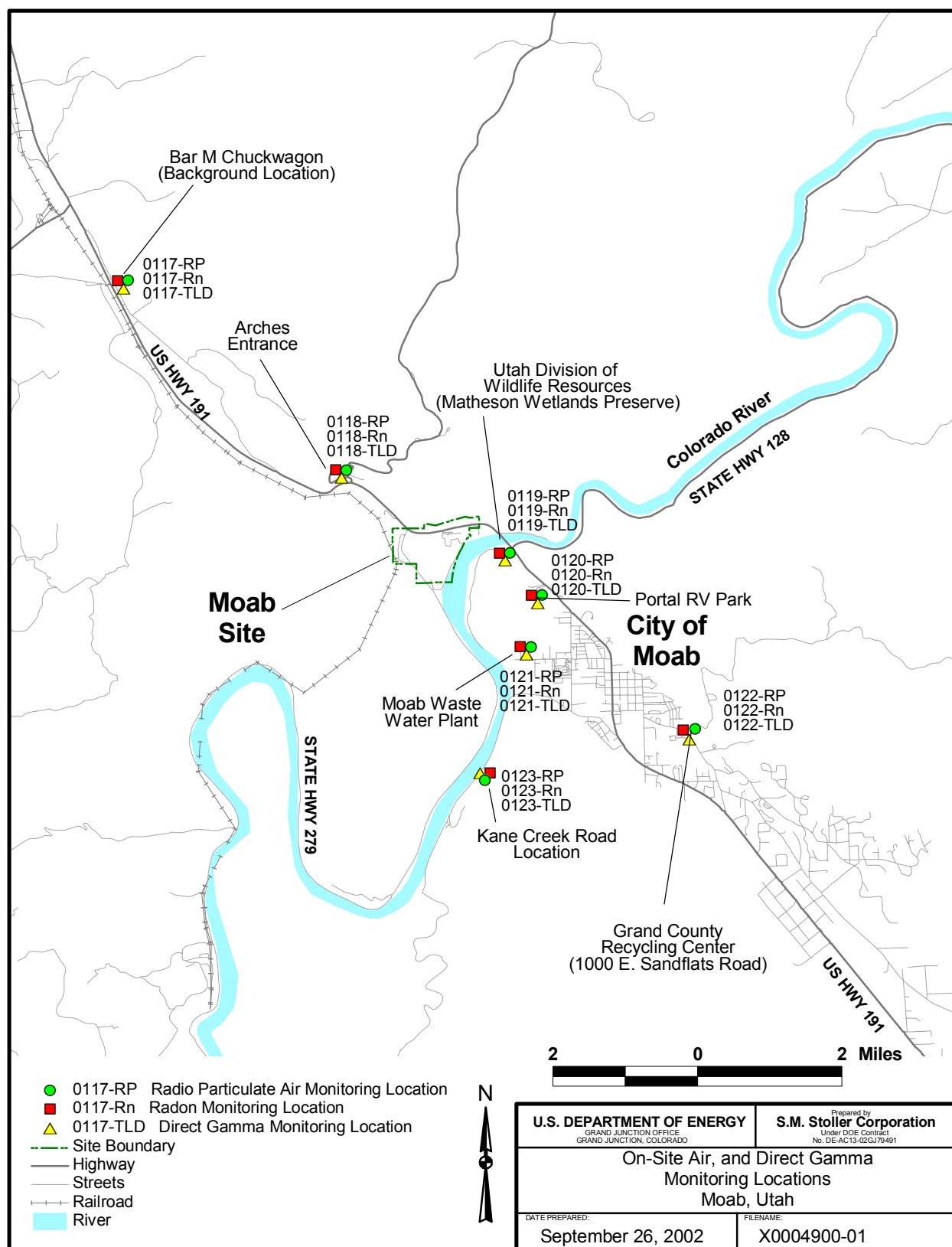


Figure 4. Off-Site Background Air Monitoring Locations

Radon will be monitored using a single Landauer alpha sensitive detector (i.e., radon cups). The radon cup will be placed in a polyvinyl chloride (PVC) protective housing. The PVC housing will be attached to a fence line or to a metal t-post at approximately 1-meter above the ground surface. Radon cups were deployed at the Moab Project Site beginning in April 2002. Radon cups are exposed and collected in 3-month (i.e., quarterly) intervals. Immediately upon collection, an adhesive metal foil will be placed over the open portion of the exposed cup. The exposed cups are sent to Landauer, Inc. for analysis within one week of collection. Upon receipt from the laboratory, a copy of the analytical data reports will be provided to the Information Services organization for data base management.

Additional radon monitoring locations may be added as deemed necessary by project management. Radon monitoring in portions of existing on-site buildings and structures may become necessary to document worker exposures in those areas.

Field data (e.g., cup number, sample location, date of placement, date of retrieval, etc.) for individual radon and gamma monitoring locations will be collected and maintained in a field logbook.

### **4.3 Direct Gamma**

As shown in Figures 3 and 4, the direct gamma radiation monitoring network consists of sixteen on-site locations and seven off-site background locations. Thirteen of the sixteen on-site locations are placed on or near the actual property boundary. The remaining three locations are located on top of the tailings pile. All off-site direct gamma monitoring locations are co-located with each radon and radioparticulate monitoring location (see Section 4.2).

Direct gamma radiation will be measured using a single calcium sulfate dysprosium ( $\text{CaSO}_4\text{Dy}$ ) TLD at each location. The TLD will be attached to a fence line or to a metal t-post at approximately 1-meter above the ground surface. TLDs were deployed at the Moab Project Site beginning in April 2002. Exposed TLDs will be collected, and replaced with unexposed TLDs quarterly. Exposed TLDs will be sent to an approved laboratory for analysis within one week of collection.

### **4.4 Meteorological Monitoring**

According to DOE's *Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991), "...environmental protection activities, including the assessment of impacts of planned and unplanned airborne releases on public health and safety and the demonstration of compliance with applicable Federal, State, and local laws and regulations, and Orders, require meteorological information representative of conditions at DOE facilities. This information is needed to assess the transport, diffusion, and deposition of materials released to the atmosphere by a DOE facility. It is also important in the design of environmental monitoring networks." In addition to the above uses, meteorological monitoring data have been used extensively by DOE at environmental restoration and construction sites to document contractor/subcontractor claims for down time due to "bad weather days."

DOE initiated meteorological monitoring at the Moab Project Site beginning in July 2002. A meteorological monitoring station has been installed north of the main construction office at the entrance to the Moab Project Site (Figure 3). Parameters to be measured or calculated include wind speed, wind direction, standard deviation of wind direction, temperature, evapotranspiration potential, precipitation, solar radiation, and relative humidity. Meteorological monitoring data will be collected quarterly and summarized/reported annually.

## 4.5 Opacity

In compliance with U.A.C. 307–205, *Emission Standards: Fugitive Emissions and Fugitive Dust*, fugitive dust emissions from all construction activities associated with the Moab Project Site shall not exceed 20 percent opacity. To ensure compliance with this standard, only State of Utah certified opacity readers will be used when making opacity determinations. All opacity determinations will be documented and reported to the construction project manager.

## 4.6 Responsibilities

The Environmental Support organization has primary responsibility for implementing the components of this environmental air-monitoring program at the Moab Project Site, and ensuring that site activities are in compliance with applicable federal and state regulations and DOE Orders. Specific areas of responsibility include, but are not limited to the following tasks:

- Procurement, installation, periodic calibration, and maintenance of equipment.
- Weekly particulate filter collection and replacement.
- Quarterly TLD and radon cup collection replacement.
- Preparing radon cups and TLDs for shipment to analytical laboratories.
- Supplying opacity certified personnel to support remedial activities.
- Maintenance of analytical data packages, field logbooks.
- Compliance reporting (preparation of Annual Site Environmental Reports, etc.).
- Adding new monitoring locations as needed.
- Updating procedures, SAPs, etc., as needed.
- Procurement of sampling supplies (e.g., filters, radon cups, TLDs, etc.).
- Notification of construction/program management of any non-compliant condition discovered as a result of air quality monitoring.

## 5.0 Analytical Procedures

Filters collected for radioparticulate analyses will be submitted to the Grand Junction Office (GJO) Analytical Chemistry Laboratory. Analytical reporting limits are values slightly above the instrument detection limits, and are used to negate the variability associated with instrument detection limits. Reporting limits and analytical methods applicable to radioparticulate, radon, and gamma analyses are summarized in [Table 2](#).

Table 2. Reporting Limits and Analytical Methods

Analyte		Reporting Limit	Analytical Method
Radioparticulates			
	Radium-226	1 pCi/filter <sup>1</sup>	Alpha Spectrometry (RC–4) <sup>2</sup>
	Uranium (total)	1 µg/filter	ICP Mass Spectrometry (AS–6)
	Thorium-230	0.5 pCi/filter	Alpha Spectrometry (RC–4)
	Polonium-210	1 pCi/filter	Alpha Spectrometry (RC–4)
Radon		0.07 pCi/liter	Landauer, Inc., 1994
Direct Gamma Radiation		1 mrem	Environmental Laboratories, Inc., Midwest Laboratory

<sup>1</sup>Reporting limit may vary depending on matrix interferences.

<sup>2</sup>AS–6 and RC–4 are specific GJO Analytical Chemistry Laboratory standard operating procedures.

Radon cups will be analyzed by Landauer, Inc., according to an internal procedure and in accordance with the *Quality Assurance Manual for Radon Monitoring, Revision Number 8* (Landauer, Inc., 1994). TLDs will be analyzed by Environmental Laboratories Inc., Midwest Laboratory (formerly Teledyne Brown Environmental Labs) according to *Preparation and Read-out of Teledyne Isotopes TLD Card, TIML–TLD–01, Revision 6* (Teledyne Isotopes 1995).

Using the reporting limits listed in Table 2, the following dose/concentration sensitivities for each analyte are summarized in Table 3 as follows:

Table 3. Dose/Concentration Sensitivities for Analytical Parameters

Analyte	Dose/Concentration Sensitivity
Radium-226	0.06 mrem
Thorium-230	0.73 mrem
Polonium-210	0.04 mrem
Uranium	0.02 mrem
Radon-222	2.33. mrem
Gamma Radiation	1.0 mrem

## 6.0 Quality Assurance and Quality Control

Quality assurance (QA) requirements for field and laboratory activities associated with the SAP are specified in procedure GN–6 (P), "Standard Practice for Quality Assurance," of the *Grand Junction Office Environmental Procedures Catalog* (Manual GJO 6). A *Document Addition/Revision* form will be prepared to modify certain requirements of the procedures so that QA activities are tailored to the air monitoring activities discussed in this plan. The QA procedures to be used in association with the monitoring activities described in this SAP complies with the QA requirements for environmental characterization as discussed in DOE Order 231.1, *Environmental, Safety, and Health Reporting*, and DOE Order 5700.6C, *Quality Assurance*.

The GJO Analytical Chemistry Laboratory performs analyses in support of DOE environmental radiological monitoring programs and participates in the inter-laboratory QA Program coordinated by the DOE Environmental Measurements Laboratory. The Laboratory also participates in three non-DOE inter-laboratory QA programs: (1) the U.S. Environmental Protection Agency (EPA) Environmental Measurements Systems Laboratory for radioactive materials; (2) the American Industrial Hygiene Association Proficiency Analytical Testing Program for airborne metal, silica, and asbestos; and (3) the American Industrial Hygiene Association Identification and Quantification of Asbestos on Bulk Materials Program.

Quality control during air sampling will be achieved by implementing and strictly adhering to guidance contained in the *Quality Assurance Handbook for Air Pollution Measurement Systems Volume II* (EPA 1989). Guidance contained in this handbook includes calibration procedures, quality control flow rate checks, independent performance audit checks, filter handling protocol, laboratory quality control, personnel chain of command, co-located sampling, and data validation protocol.

## 6.1 Sample Control

To maintain evidence of authenticity, samples will be properly identified and made discernible from other like samples. Sample containers will be labeled with the sample identification number, site identification number, date collected, and date of the sample.

Chain-of-Sample-Custody records will be used to document all transfers in the possession of samples and to show that a sample was in constant custody since its collection. Chain-of-Sample Custody procedures GN–9 (P) apply to the environmental air monitoring activities at the Moab Project Site, and are included in Appendix A, *Field Sampling Procedures*, of this SAP.

## 6.2 Records and Document Control

When recording field data, sampling personnel will follow procedure GN–3 (P), "Standard Practice for Field Documentation Process" of the *Grand Junction Office Environmental Procedures Catalog* (Manual GJO 6). All entries in the field notebook will be made with indelible ink and will be legible, accurate, complete, and traceable to the sample measurements and/or site location. This document is intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the field sampling activities. Field notebooks will be stored consistent with the guidance provided in the Moab working file index which protects them from loss or damage, and will become part of the permanent record file.

A copy of each Chain-of-Sample Custody form will be retained for traceability in case the sample is lost or destroyed. The copy received by the GJO Analytical Chemistry Laboratory or by the subcontracted laboratory will be included in the final analytical reports. All information/data gathered during the course of the fieldwork will be maintained in the project record file as defined in the working file index. If an error is made when recording field data, the method of correction will be to draw a line through the error and enter the correct information. The erroneous information will not be obliterated. When practical, any subsequent error discovered will be corrected by the person who made the entry. All corrections will be initialed and dated.

A Request for Analytical Services form, which provides the laboratory with the type of analyses to be performed on the samples, will be completed and submitted to the GJO Analytical Chemistry Laboratory along with the air filters. Analytical requirements for subcontracted laboratories are established during the initial procurement of analytical services.

### **6.3 Sampler Calibration and Flow Checks**

Qualified GJO personnel will calibrate the low-volume continuous air samplers in accordance with manufacturer specifications and procedures. Samplers will be calibrated prior to field deployment, and annually thereafter. If a sampler malfunctions and requires repair, the sampler will be re-calibrated before being returned to service.

### **6.4 Analytical Laboratory QA/Quality Control**

Laboratories (both GJO and subcontracted) used for the analysis of air monitoring filters and detectors will have a documented QA program and will follow all relevant laboratory procedures. The GJO Quality Assurance Manual defines the QA program implemented by the GJO Analytical Chemistry Laboratory. QA program requirements, consistent with the GJO QA program requirements derived from 10 CFR 830.120 and DOE Order 5700.6C, and rights of access for verification of QA program implementation, will be applied to subcontracted laboratories through the appropriate procurement documents. Analytical quality control will include, as appropriate, the analysis of blanks, duplicates, spikes, and surrogate samples as specified by the method.

## **7.0 Data Review and Reporting**

Data collected during field sampling activities and reported by the GJO Analytical Chemistry Laboratory and the subcontracted laboratories will be entered into an ORACLE database and managed by the Information Services organization. As required by DOE Order 231.1, *Environment, Safety, and Health Reporting*, data will be formally summarized and presented in the Annual Site Environmental Report. All monitoring data will be made available to, and shared with other organizational elements as-needed (e.g., on-site gamma exposure data may be used by the Health and Safety organization for determining occupational exposures; Project Management will be immediately notified in the event that monitoring data demonstrate any episodes on non-compliance, etc.). After field and analytical data have been entered into the ORACLE database, the database manager will produce a draft data report. The database manager will review the draft report to ensure that all data fields are within expected ranges. When all data are verified, the report will be finalized. The final report will then be forwarded to Environmental Sciences staff for a compliance review.

## 8.0 Health and Safety

All fieldwork associated with the Moab Project Site will be performed in accordance with the *Moab Project Site Health and Safety Plan* (DOE 2001). This plan: (1) Describes the required safety training for on-site personnel and visitors; (2) Discusses the personal protective equipment (PPE) requirements; (3) Describes the potential contaminants of concern at the Moab Project Site and their exposure limits; (4) Outlines plans for emergency response and evacuation; and (5) Provides guidance for spill cleanup and abatement.

## 9.0 References

10 CFR Part 40.65, *Effluent Monitoring Reporting Requirements*.

40 CFR, Part 50, *National Primary and Secondary Ambient Air Quality Standards*

40 CFR 192, *Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings*

Grand Junction Office, 1996, *GJO Quality Assurance Manual*, GJO–1, Grand Junction, Colorado

———, *GJO Environmental Procedures Catalog*, GJO–6 (continuously updated), Grand Junction, Colorado

———, 2001, *Moab Project Site Health and Safety Plan*, GJO–MOA 1.3 (continuously updated), Grand Junction, Colorado

Landauer, 1994, *Quality Assurance Manual for Radon Monitoring Services, Revision Number 8*, Glenwood, Illinois

Teledyne Isotopes, 1995, *Preparation and Read-Out of Teledyne Isotopes TLD Card, TIML–TLD–01, Revision 6*, Northbrook, Illinois

U.S. Environmental Protection Agency (EPA), 1989, *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II*

U.S. Department of Energy (DOE), DOE Order 5700.6C, *Quality Assurance*

———, DOE Order 231.1, *Environment, Safety, and Health Reporting*

U.S. Department of Energy (DOE), DOE Order 5400.1, *General Environmental Protection Program*

———, DOE Order 5400.5, *Radiation Protection of the Public and the Environment*

———, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH–0173T, January 1991

Utah Administrative Code (U.A.C.), *R307–205–6: Emission Standards: Fugitive Emissions and Fugitive Dust*, September 2001, Salt Lake City, UT

———, *R313–15–301: Standards for Protection Against Radiation, Dose Limits for Individual members of the Public*, September 2001, Salt Lake City, Utah

End of current text

**APPENDIX A**

**FIELD SAMPLING PROCEDURES**

# **SAMPLING FOR AIRBORNE RADIOPARTICULATES USING A LOW-VOLUME CONTINUOUS AIR SAMPLER**

## **1.0 Purpose**

This procedure provides instructions for filter installation, removal, and sample flow-rate calibration of a continuous low-volume air sampler.

## **2.0 Application**

This procedure applies to the use of a RADeCO Model AVS-28A low-volume, constant flow air sampler.

## **3.0 Definitions**

**Low-Volume Continuous Air Sampler** - An instrument for sampling total suspended particulates in the air for a specific time period at a specific flow rate. This instrument is used to determine compliance with ambient air quality standards and for occupational health monitoring purposes.

## **4.0 Calibration**

The samplers will be calibrated annually in accordance with manufacturer specifications.

## **5.0 Equipment and Materials**

- RADeCO Instruments. Regulated Low-Volume, Constant Flow Air Sampler, Model AVS-28A (see attached product specification sheet).
- 47-millimeter (mm) diameter glass fiber filters.
- 50-mm filter canister.
- Airborne radioparticulate sampling data sheets.

## **6.0 Procedures**

### **Filter Installation:**

- Unscrew combination filter holder at "O" ring.
- Wipe away any dust with disposable wipe inside and outside of combination filter holder.
- Unscrew front end of combination filter holder and wipe away any dust from around front plate and on plastic screen.
- Lay the plastic screen in holder on a clean, flat surface. Place one 47-mm filter on screen and replace front end of combination filter.
- Replace front end of combination filter holder to "O" ring end.
- Turn air sampler on (switch on back of motor) and reset timer, if necessary, by pushing in button on timer gauge.

**Filter Removal:**

- Turn off sampler and unscrew combination filter holder at "O" ring.
- Lay filter holder on flat surface and remove front end of holder.
- Remove filter and place in 50-mm filter canister.
- Record sample location, and time period (date) of the sample on the filter canister.
- Place filter canister in ziplock plastic bag for convenient storage prior to submittal to lab.

**7.0 Airborne Radioparticulate Sampling Data Sheet**

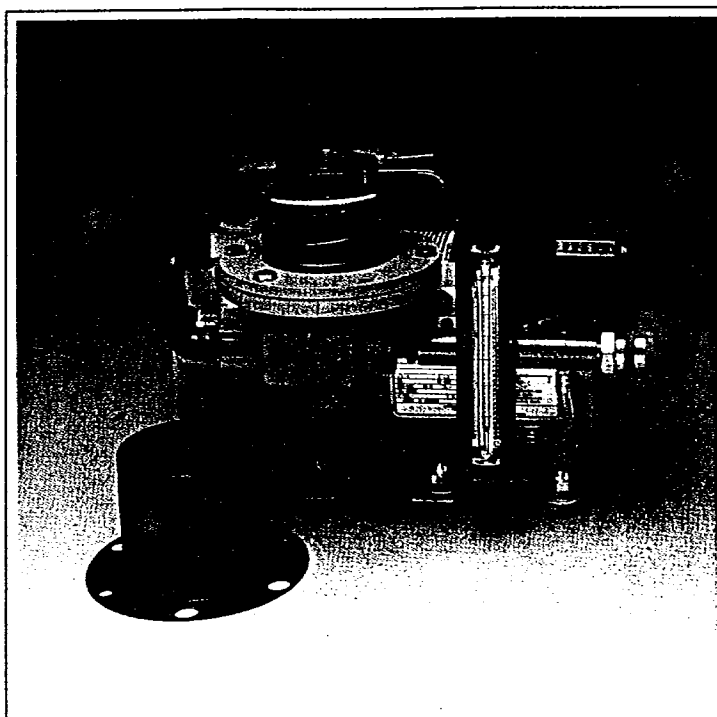
- Fill out the data sheet for each sample collected (Figure 1).
- Record filter number (i.e., mmyy-xx), xx representing the monitoring location number.
- Record the sampling rate in liters per hour.
- Record the sampling start date (mm/dd/yy) and time in hours.
- Record the sampling end date (mm/dd/yy) and time in hours.
- Record the total sampling time in hours (obtained from the timer/clock).
- Calculate and store total sample volume (liters).
- Record comments about the air sampling pump or any unusual conditions.

# PORTABLE CONSTANT FLOW AIR SAMPLER

## MODEL AVS-28A™

*Industry Workhorse Continues to Lead the Field*

- **CONSTANT AIRFLOW MAINTAINED WITH A  $\Delta P$  ACROSS THE FILTER OF UP TO 17" OF MERCURY (FLOW RATE DEPENDENT)**
- **BALANCED, EASY TO CARRY COMPACT SYSTEM**
- **FLOW RATE INDICATION ON ROTAMETER, CFM OR LPM**
- **RATED FOR CONTINUOUS DUTY**
- **LOW NOISE LEVEL**
- **MINIMUM MAINTENANCE**
- **QUALITY ASSURANCE STANDARDS MEET 10CFR50, APPENDIX B**
- **OPTIONAL ELAPSED SAMPLE TIME INDICATOR**



The **Model AVS-28A™** Portable Constant Flow Air Sampler is a continuous duty, constant flow device. It can be used with filters and cartridges in the collection of airborne contaminants, or as a regulated, positive displacement vacuum supply for continuous air monitors and stack sampling systems.

The ability of the **AVS-28A™** to maintain a preset sample flow rate is controlled by the unique side-mounted regulator valve. The SAIC regulator valve is not a bypass design, and therefore the exhaust contains only sampled air. The response curve on the reverse side shows the superior ability of the **Model AVS-28A™** to compensate for added  $\Delta P$  across sampling media.

The sampling flow rate is read out on a side-mounted rotameter that measures the differential pressure across the in-line aluminum venturi. All units are individually calibrated and traceable to the NIST.

# PORTABLE CONSTANT FLOW AIR SAMPLER

## MODEL AVS-28A™

### SPECIFICATIONS

**AIR FLOW RATE:** Adjustable from 0.5 to 3.5 CFM (10 to 100 LPM). Air flow calibrations made to individual unit characteristics

**AIR FLOW INDICATION:** Venturi mounted rotameter

**AIR FLOW REGULATION:**  $\pm 5\%$  of set air flow rate up to maximum capability of pump

**AIR MOVER:** Self-adjusting carbon vane type. Pump is designed for continuous operation at 26" Hg vacuum

**RESETTABLE ELAPSED TIME METER:** 9999 Hours and 60 minutes, pushbutton resettable

**MOTOR:** 1/4 HP; Thermal Overload Protection

**INPUT CONNECTION:** 3/8" Female Quick Disconnect Fitting

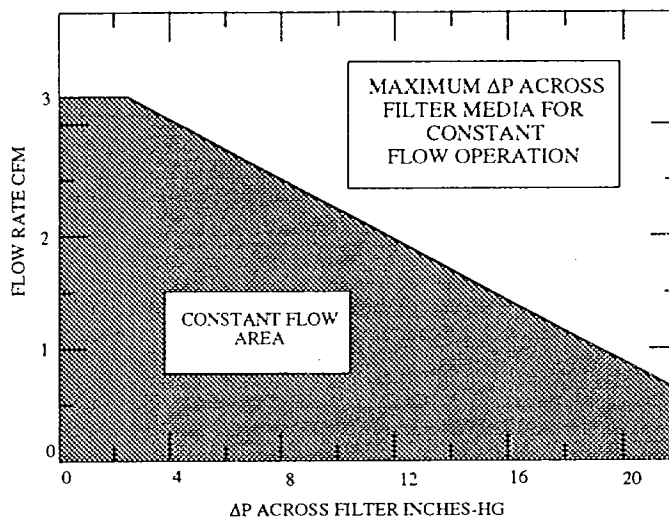
**POWER CONNECTION:** 6 foot, three wire grounded cable. U.L. Approved

**POWER REQUIREMENTS:** 115VAC, 60 Hz, 8 Amps, or  
230VAC, 50Hz, 4 Amps

**OVERALL DIMENSIONS:** 12" Long x 14" Wide x 9" High  
(30.5cm x 35.6cm x 22.9cm)

**WEIGHT:** 30 pounds (13.6 kg)

Sample Heads Available	
Model No.	Description
2500-04	2" diameter filter, open face
2500-42	47mm diameter filter, open face
2500-92	37mm diameter filter, open face
2500-91	25mm diameter filter, open face
2500-21	2" diameter filter/SAIC cartridge, open face
2500-46	47mm diameter filter/SAIC cartridge, open face
2500-45	2" diameter filter/SAIC cartridge, in-line
2500-44	47mm diameter filter/SAIC cartridge, in-line



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# MOAB SITE PROJECT ENVIRONMENTAL AIRBORNE RADIOPARTICULATE SAMPLING FIELD LOG

Month: \_\_\_\_\_ Year: \_\_\_\_\_ Sampler: \_\_\_\_\_

Sample Location Number	Week	Sample Rate (LPM)	Total Sample Time (hours)	Total Sample Volume (L)	Comments
0102-RP (On-site-east side)					
0105-RP (On-site-berm)					
0117-RP (Bar-M Chuckwagon - Background Site)					
0118-RP (Arches National Park Entrance)					
0119-RP (Matheson Wetlands)					
0120-RP (Portal RV Park)					
0121-RP (City Waste Water Treatment Plant)					
0122-RP (County Solid Waste Recycle Center)					
0123-RP (Kane Creek Road)					

# Standard Practice for Quality Assurance

## 1. Scope

1.1 This practice applies to all activities that will be conducted in accordance with the procedures in this catalog. The *GJO Quality Assurance Manual* (GJO 1) is the basis for this standard practice. Project leads should notify the QA manager of new projects or activities to ensure adequate evolution of quality issues. When a program-specific Quality Assurance Program Plan (QAPP) exists, the Work Plan will prescribe implementation of the site-specific requirements of the QAPP. Responsibility for the quality of work rests with those performing the work. Quality Assurance (QA) Groups support programs and projects by the assistance of a QA Coordinator and through monitoring and surveillance activities.

## 2. Hazard Analysis

2.1 No hazards requiring controls have been identified for this practice. Site-specific controls are specified in the Health and Safety Plan for a particular project.

## 3. Referenced Documents

3.1 Title 10, *U.S. Code of Federal Regulations*, Part 830, Section 120 (10 CFR 830.120), "Quality Assurance Requirements"

3.2 *GJO Training Manual* (GJO 4) Section 8.0 "Environmental Qualification Procedures"

3.3 *GJO Environmental Procedures Catalog* (GJO 6)

Standard Practice for Preparing or Revising Procedures for the *GJO Environmental Procedures Catalog* [GA-1(P)].

Technical Comments on ASTM D 5283-92-Standard Practice for Generation of Environmental Data Related to Waste Management Activities: Quality Assurance and Quality Control Planning and Implementation [GA-2(P)].

Standard Practice for Field Documentation Processes [GT-1(P)].

Standard Practice for Sample Labeling [GT-2(P)].

Standard Practice for Chain-of-Sample-Custody Control and Physical Security of Samples [GT-3(P)].

3.4 Contractor's *Procurement Manual* (GJO 18)

3.5 *GJO Quality Assurance Manual* (GJO 1)

Criterion 1, "Quality Assurance Program"

Criterion 3, "Quality Improvement"

QAI 3.2, "Nonconformance Reporting, Disposition, and Closure"

Criterion 8, "Inspection and Acceptance Testing"

QAI 8.2, "Calibration System"

## 4. Terminology

4.1 *Assessment*-An independent planned and documented assessment performed to determine by investigation, examination, or evaluation of objective evidence the adequacy of and compliance with established instructions, procedures, drawings, or other applicable documents, and the effectiveness of implementation of requirements.

4.2 *Calibration*-Comparison of measurement equipment with reference standards of greater accuracy to detect, quantify, report, and eliminate inaccuracies. Calibration may include adjustment or alignment, depending on the as-found condition of the equipment.

4.3 *Controls*-Documented administrative rules, orders, instructions, procedures, policies, practices, and designations of authority and responsibility.

4.4 *Corrective action*-Measures taken to reduce or eliminate conditions adverse to quality and, where necessary, to prevent recurrence.

4.5 *Corrective Action Request (CAR)*-A document used to identify significant conditions adverse to quality, identify corrective action, and record verification of corrective action taken.

4.6 *Deviation*-A departure from specified requirements or procedures.

4.7 *Document*-Any written or pictorial information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results. A document is not considered to be a record until it includes actual data, results, or information and is authenticated.

4.8 *Documentation*-A body or group of documents; or the process of generating documents or assembling of a group of documents.

4.9 *Document control*-The act of assuring that documents are reviewed for adequacy, approved by authorized personnel for release, and distributed to and used at locations where the activity is performed. Document control includes assuring changes to the documents receive the same controls as the originals.

4.10 *Indoctrination and Training*-All of the actions necessary to assure that personnel are properly trained to manage or perform activities that affect quality, such as classroom sessions, on-the-job training, or required reading. Employees must be familiar with and understand the purpose, scope, and implementation of the QA Program as it applies to their work.

4.11 *Interface*-Interaction among individuals, groups, or organizations.

4.12 *Measurement and Test Equipment (M&TE)*-Devices or systems used for calibrating, measuring, gauging, testing, or inspecting to control, to acquire data, or to verify conformance to specified requirements. M&TE includes devices or systems used to acquire research, development, or test data or to determine compliance with design, specifications, or other technical requirements.

Systems used for measurement or testing include components from the sensing element through the output or recording device.

4.13 *Nonconformance*-A deficiency in a characteristic, procedure, or documentation that renders the quality of an item unacceptable or indeterminate. Examples of nonconformances include, but are not limited to, physical defects; test failures; incorrect or inadequate documentation; and deviations from prescribed processing, inspection, test procedures or other documented technical requirements.

4.14 *Nonconformance Report (NCR)*-The document used to report the identification and disposition of nonconformances.

4.15 *Planning document*-A document that specifies the work to be completed, sampling strategies, tests required, level of quality control (QC) applied, personnel assignment and responsibilities, and deliverables. Some projects may require Field Sampling and Analysis Plans or other specified planning documents.

4.16 *Procedure*-A document that systematically specifies or describes the way an activity is to be performed. As used in this catalog, a procedure may be a test method, practice, or guide.

4.17 *Procurement document*-Purchase requisitions, purchase orders, drawings, subcontracts, specifications, and instructions formally approved and used to perform the procurement process. These documents define the requirements that must be met before items or services may be accepted.

4.18 *Program plan*-A written description of the activities required for achieving the goals or objectives of a program. The plan describes the strategy to be followed and the major actions to taken to achieve those objectives. The plan addresses program-related elements, including program interfaces, schedule, major milestones, budget, technical control, quality assurance, and program control.

4.19 *Quality Assurance*-All planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily in service.

4.20 *Quality Assurance Coordinator*-A member of the QA staff assigned to provide QA assistance to the management of activities and programs in quality assurance matters. The QA Coordinator assists in establishing the QA Program Plan and evaluating compliance with the Plan.

4.21 *Quality Assurance Program*-The system of activities associated with defining, implementing, and verifying compliance with the requirements for QA. The QA Program is described in the *GJO Quality Assurance Manual* (GJO 1).

4.22 *Quality Assurance Officer*-The Manager of the contractor organization to which QA staff are assigned. The Manager is independent of Program/Project assignment.

4.23 *Quality Assurance Program Plan*-A document identifying the requirements that the Program or Activity manager and the QA Coordinator have judiciously selected from the overall QA Program, along with customer's QA requirements that are to be imposed on a particular program.

4.24 *Quality Control*-Those quality activities necessary to control and verify the features and characteristics of an item, material, process, facility, or service to specified requirements.

4.25 *Record (Quality Assurance)*-A document that furnishes evidence of the quality of items or activities and that has been verified and authenticated as technically complete and correct. Records may include photographs, drawings, magnetic tape, and other data-recording media.

4.26 *Sampling and Analysis Plan*-A plan that defines sampling strategies, data-quality objectives, traceability, QC, and records requirements.

4.27 *Shall*-Denotes a mandatory requirement or action. "Must" and "will" are synonymous with "shall" and "will".

4.28 *Signature (or signed)*-A person's name, written by that person, including given names or initials and full last name.

4.29 *Stop Work*-To discontinue all or any of the activities related to the fulfillment of contract obligations.

4.30 *Stop Work Order*-A formal request by an oversight organization member to suspend activities when other measures to obtain corrective action have failed, and risk resulting from loss, damage, or continued noncompliance is high (Reference 3.5).

4.31 *Surveillance*-The act of monitoring or observing to determine whether an item or activity conforms to specified requirements.

4.32 *Technical review*-A formally documented review of technical material performed by individuals independent of those directly responsible for the work but who may be members of the organization that performed the work.

4.33 *Traceability*-The capacity for tracing the history, application, or location of an item or sample by means of documentation or physical identification.

4.34 *Variance*-A deviation from "must," "shall," or "will" statements in a procedure.

## 5. Significance and Use

5.1 The GJO Quality Assurance Program is defined by the *GJO Quality Assurance Manual* (GJO 1), which is based on DOE Order 414A, Quality Assurance. The *GJO Quality Assurance Manual* (GJO 1) specifies QA requirements which are graded into "Standard" and "Q" level requirements. The *GJO Environmental Procedures Catalog* (GJO 6) implements the "Standard" level requirements unless the planning document or the procedure specifies "Q" level requirements.

5.2 This practice defines the QA Program elements that are routine to the use of test methods, guides, and practices. This practice should be used along with the planning documents that may specify additional program-specific requirements.

## 6. Procedure

6.1 The Quality Assurance Program will be implemented through the *GJO Quality Assurance Manual* (GJO 1), QAPPs, planning documents, and the instructions in this catalog.

6.2 QA will assist the Program or Project Manager in evaluating the need for and preparing a QAPP to grade the level of quality needed for the program. QA will also review planning documents to verify that any QA requirements for the program are included.

6.3 The planning document will describe and plan field activities, as described in Technical Comments on ASTM D 5283.92-Standard Practice for Generation of Environmental Data Related to Waste Management Activities: Quality Assurance and Quality Control Planning and Implementation [GA-2(P)]. The preparer of the planning document needs to use the applicable program QAPP requirements as an input to the Work Plan.

6.3.1 The planning document will designate the organization(s) responsible for performing particular tasks and the interfaces between work teams, support organizations, and program personnel; and will specify responsibilities and authorities of team members. The planning document will specify how the quality of work will be determined and by whom.

6.3.2 Managers can make program/project-specific changes to procedures or project planning documents or support organization desk procedures using QAI 1.6, "Program Directives."

6.4 *GJO Quality Assurance Manual*, QAI 1.5, "Work Readiness Reviews," provides instructions for performing work readiness reviews.

6.5 Personnel performing work will be trained as defined in the *GJO Training Manual* (GJO 4). Only trained personnel will be assigned to conduct work using the *GJO Environmental Procedures Catalog* (GJO 6). A trained person can supervise the assistance of personnel who have not received training on a particular procedure. The trained person will record any

data and will be responsible for the results of the activity. The Project Manager or designee will verify personnel qualifications and training prior to work assignment.

6.6 The purchase of items or services will be accomplished as specified in the contractor's procurement manual. As appropriate, procurement documents will specify the scope of work, technical requirements (reference to existing codes or standards is recommended where possible), rights of access, and documents to be submitted.

6.6.1 QA review of procurement documents may be considered when the items to be purchased must meet quality requirements or other standards. Examples of procurements where QA review is beneficial are subcontracted services, instrument calibration, and equipment fabrication.

6.7 Work will be controlled by instructions, procedures, and drawings. Procedures will be prepared, reviewed, approved, and issued prior to beginning the work. The procedures will be controlled to ensure that personnel have current and correct copies of the procedures, instructions, and drawings. Standard Practice for Preparing or Revising Procedures from the *GJO Environmental Procedures Catalog* [GA-1(P)] will be used for procedures in this catalog.

6.7.1 Should modification to a procedure be needed for a particular task, the revised procedure must be documented as described in Standard Practice for Preparing or Revising Procedures from the *GJO Environmental Procedures Catalog* [GA-1(P)].

6.7.2 Variations from procedures in the field will be documented on the data sheet or field notebook. The variation will be evaluated for its effect during data review.

6.8 The *GJO Quality Assurance Manual* (GJO 1) QAI 8.2 "Calibration System" applies to any activity that requires calibrated M&TE.

6.8.1 Personnel using instruments that affect or evaluate the quality of an activity are responsible for ensuring that the instrument is controlled and that accuracy is documented. The instruments must have a label that documents the calibration status. If labeling is not feasible, the records must show current calibration.

6.8.2 Instruments will be checked for proper functioning daily before use. The documentation must show that the instrument is functioning within the established parameters. Verification of a current calibration sticker will be performed during the operational check.

6.9 All project work activities will be documented in permanent form. Records must be legible, identifiable, reproducible, signed, and dated. Records will be protected from loss or damage by reasonable handling of documents. Corrections will be made by crossing through the entry with a single line, entering the correction, initialing, and dating. Refer to Standard Practice for Field Documentation Processes [GT-1(P)] for record preparation, protection, and disposition.

6.10 Sample traceability will be maintained through use of Standard Practice for Sample Labeling [GT-2(P)] and Standard Practice for Chain-of-Sample-Custody Control and Physical Security of Samples [GT-3(P)].

6.11 The planning document will specify QA objectives for measurement data, if applicable (such as accuracy, precision, completeness, representativeness, and comparability). The plan will detail how the objectives will be satisfied.

6.12 The following types of document reviews will be conducted:

6.12.1 The individual performing the test or practice will review the data to verify correctness. When data are collected electronically, the individual will review the printed representation.

6.12.2 A person other than the person recording the data will review individual data sheets or records for reasonableness and completeness. The reviewer will document the review on the data sheet by a legible signature and date.

6.12.3 Formal and informal reports will be reviewed as described in the contractor's administrative policies and procedures.

6.12.4 Reviews of procedures in the *GJO Environmental Procedures Catalog* (GJO 6) will be conducted as described in Standard Practice for Preparing or Revising Procedures for the *GJO Environmental Procedures Catalog* [GA-1(P)]. Contractor procedure reviews will be conducted and documented as prescribed by the contractor's administrative policies and procedures.

6.12.5 Procurement documents will be reviewed for inclusion of technical requirements, deliverables, scope of work, quality requirements, and rights of access (when appropriate).

6.12.6 Data-quality reviews will assess whether the data quality objectives, as a whole, have been achieved.

6.13 Items or activities that do not conform to written requirements will be identified, controlled, and corrected. Nonconformances are deficiencies in characteristic, procedure, or documentation that render the quality of an item unacceptable or indeterminate. Nonconforming items or data that have been transmitted to other organizations must be reported and evaluated as directed in QAI 3.4 of the *GJO Quality Assurance Manual* (GJO 1). The person who identifies a nonconformance will initiate a report using the Nonconformance Report (Form 1594). The QA Coordinator will be notified of and assist in the administration of the Nonconformance Report.

6.14 All work will be conducted in accordance with appropriate quality standards. Those with the responsibility for the work have primary responsibility for achieving quality and taking corrective actions as needed to maintain the quality of work.

6.14.1 When conditions adverse to quality have been identified through Nonconformance Reports, audits, or surveillance and corrective action has been ineffective, the contractor's QA manager will elevate the issue to management.

6.14.2 When significantly adverse conditions have been identified and management response has not been initiated or is ineffective, suspension of activities may be initiated by the contractor's QA manager.

6.15 QA will verify implementation of the QA Program by conducting assessments and surveillance of programs and activities of contractor organizations. Qualified personnel will conduct audit activities using the requirements in the *GJO Quality Assurance Manual* (GJO 1) and internal QA procedures.

## 7.0 Keywords

7.1 See Section 4, "Terminology."

# Standard Practice for Health and Safety

## 1. Scope

1.1 It is the policy of the GJO Contractors to provide a safe and healthful working environment for all employees. Under no circumstance will employee safety be sacrificed in lieu of productivity goals. It is also policy to comply with U.S. Department of Energy (DOE) orders and Federal, State, and local regulations applicable to health and safety activities.

## 2. Hazard Analysis

2.1 No hazards requiring controls have been identified for this practice. Site-specific controls are available in the Health and Safety Plan for a particular project.

## 3. Referenced Documents

3.1 *GJO Health and Safety Manual* (GJO 2). The manual is used to provide direction to Health and Safety staff when carrying out assigned tasks. This manual is divided into four chapters: "Health and Safety Administration," "Industrial Hygiene and Safety," "Radiation Protection Program," and "Investigation and Reporting of Off-Normal Occurrences."

3.2 *GJO Health and Safety Manual* (GJO 2):

Safe Work Permit, Procedure 2.3

Job Safety Analysis, Procedure 2.8

## 4. Interfaces

4.1 The Contractor Health and Safety (H&S) organizations are available to provide technical health and safety support to procedure development activities and to evaluate the hazards associated with carrying out those procedures. They can provide technical and field support in health physics and radiation control, industrial hygiene, and industrial safety.

4.2 The H&S organizations interface with line management, program offices, health and safety personnel for DOE and the Occupational Safety and Health Administration, and consultants that provide direct support in the area of employee health and safety.

## 5. Significance and Use

5.1 All matters of health and safety must comply with the *GJO Health and Safety Manual* (GJO 2). It is the responsibility of project leads to contact the H&S manager when new projects or activities begin to ensure that an assessment of all hazards is made and that a determination of appropriate controls to address these hazards occurs.

5.2 Each procedure in this catalog contains a **mandatory** section entitled "Hazard Analysis" that identifies each hazard requiring controls and describes mitigation of the hazard. Each task listed in this document that involves a hazard to the worker has a "control point" identified. It is critical that the hazard be understood by the worker and that it be mitigated before proceeding to the next step of the procedure.

5.3 If no hazard that requires controls is identified, the "Hazard Analysis" section should contain the notation "No hazards requiring controls have been identified. See the Health and Safety Plan for the project for site-specific controls."

## 6. Keywords

6.1 Controls, hazards, health and safety, Health and Safety Plans, health and safety policy, health and safety procedures, OSHA, and safety.

End of current text

# Standard Practice for Field Documentation Processes

## 1. Scope

1.1 This standard practice covers reproducibility, legibility, accuracy, completeness, protection, identification, and error correction of records. The practice describes the control, data entry, content, review, and storage of field documents such as logbooks, field notebooks, data sheets, and other records.

## 2. Hazard Analysis

2.1 No hazards requiring controls have been identified. Site-specific controls are available in the Health and Safety Plan for a particular project.

## 3. Referenced Documents

3.1 *General Administrative Procedures Manual* (STO 100), Section 3, "Records Management Plan."

3.2 GJO *Quality Assurance Standards* (GJO 1) Criterion 4, "Documents and Records."

3.3 U.S. Environmental Protection Agency, *Test Methods for Evaluating Solid Waste, Vol. II, Field Manual, Physical/Chemical Methods*, SW-846, Office of Solid Waste and Emergency Response, November 1986, 3rd Edition.

## 4. Terminology

4.1 *Records*—Information or data on a specific subject collected and preserved in writing or other permanent form that has been verified and authenticated as technically complete and correct. Records may but are not limited to include data sheets, logbooks, field notebooks, maps, drawings, photographs, and electronic data-recording media.

4.2 *Technical record books*—For purposes of this practice, technical record books will refer to logbooks and field notebooks. These books are to be bound and the pages consecutively numbered.

## 5. Significance and Use

5.1 This practice will be used to document results of tasks performed using the *GJO Environmental Procedures Catalog* (GJO 6), unless the project Work Plan provides an alternate practice.

5.2 This practice includes the use of technical record books for direct data entry or as journals referring to the location of associated supporting documents for activities.

5.3 Documentation of the results produced from performing tasks is necessary to provide adequate evidence of compliance with requirements, provide an adequate basis for design decisions, and document techniques and conditions of sample collection.

## 6. General Procedures for Records

6.1 All records produced from work performed according to procedures in the *GJO Environmental Procedures Catalog* (GJO 6) must meet the following requirements:

6.1.1 Records must clearly describe the work performed. Enough detail must be provided to enable someone of equivalent skill and experience in the technology to repeat the work as originally performed.

6.1.2 Records must be clear, legible, and reproducible. Black ink is preferred. Reproducible photocopies of penciled documents are acceptable as records.

6.1.3 Errors will be corrected by lining through the incorrect entry with a single line, making the correction, and initialing and dating the correction. The erroneous information must not be obliterated or erased.

6.1.4 Records must specify the activity conducted, the program sponsor, and the method used, if applicable. The signature of the person who performed the work and the date it was

performed must appear on each page of a record and on any attached sheets. (Initials are acceptable if an initials log identifies the person.)

6.1.5 For short-term tasks, the Work Plan will define the records to be maintained for each task conducted and the disposition of the records. The following are suggested records of a short-term task:

6.1.5.1 Operational check data.

6.1.5.2 Data sheets.

6.1.5.3 Technical record books.

6.1.5.4 Official correspondence.

6.1.5.5 Planning documents.

6.1.5.6 Electronically or magnetically stored data.

6.1.6 For ongoing programs, a Working Records File Index defines what records will be generated, how long they will be retained, and the disposition of the records (see References 3.1 and 3.3).

6.1.7 Records must be protected against damage, deterioration, and loss while in the field, during data review, and until they are submitted to a storage facility. Records must be isolated from any source of contamination.

6.1.8 An independent reviewer will review data sheets or data contained in technical record books, as well as electronic data collection and data entry, as described in Section 7.5.

6.1.9 All data will be reviewed before personnel leave a remote site. The review will ensure that no additional sampling or data acquisition is required before departure.

6.1.10 When the procedure specifies compilation of data sheets, the data must be legible and traceable to the activity, project, and method used. The person completing the data sheet will sign and date the sheet and ensure that applicable spaces are completed.

## 7. Procedures for Technical Record Books

7.1 Technical record books will be bound books with sequentially numbered pages. Each book will be given a unique identifier.

7.2 *Issue and Control of Technical Record Books*—A technical record book will be assigned to an activity or a person for use on a project. The technical record book will be transmitted to the Project Manager or designee upon completion. If a technical record book contains information on more than one activity or project, the technical record book will clearly identify the portion associated with each activity or project. Reproducible copies of applicable sections of these books may be submitted to the Project Manager or designee as records.

7.2.1 The Project Manager shall determine the following and make a written record of the decisions:

7.2.1.1 Who will issue technical record books.

7.2.1.2 The number of each technical record book and the person to whom the book is issued.

7.2.1.3 The expected location for each technical record book when not in use (building and room number).

7.2.1.4 The reviewer of each technical record book and the frequency of reviews.

7.2.1.5 Whether support organizations are to use technical record books dedicated to the project or whether they will be required to furnish copies of applicable pages from technical record books supporting several projects.

7.2.2 The person to whom a technical record book is issued shall take the following steps upon receipt of a new technical record book:

7.2.2.1 Review general information on maintenance of the technical record book.

7.2.2.2 Complete the information block (if any) on the first sheet inside the front cover.

7.2.2.3 Identify the technical record book by entering the project number and title and the applicable task or subtask numbers as appropriate.

7.2.2.4 Determine whether to reserve specific pages for a Table of Contents and for the names of people who make entries and who will review the technical record book.

7.2.2.5 The first entry in the book shall describe the work covered and, as appropriate, the name of the sponsor, the Work Order or Statement of Work number, and the objectives of the work.

7.2.2.6 Prepare and maintain a list of the printed name, written signature, and initials used by each person who is authorized to make entries, including review entries.

### 7.3 *Rules for Data Entry*

7.3.1 Pages shall be kept intact. No page is to be left completely blank or removed from the book.

7.3.2 Use pages consecutively. If a page has entries from more than 1 day, each entry shall be signed and dated. If a page or part of a page must be left blank, it must be ruled across, signed, and dated. If entries for a given subject are made on two or more pages that are not consecutive, each page must be cross referenced to the previous and following entries.

7.3.3 Record all data as required by procedures for the activity being performed. Enter all data directly in a technical record book when practical. If loose sheets, such as test data sheets, photocopies, or photographs must be added to a technical record book, proceed as follows:

7.3.3.1 Glue, tape, or staple each sheet or part of a sheet to the next blank page or blank space, according to the amount of space needed.

7.3.3.2 Enter on the page of the technical record book a description of the material that is attached, and enter on each attachment the technical record book number and page number. This information will allow identification of the attachment if it comes loose.

7.3.4 Describe or reference in the technical record book any other permanent written or visual records generated for the project and not readily available in the open literature or that cannot be directly inserted because of size or bulk (e.g., data sheets, computer printouts, films, or magnetic media). Any project records that are cited must be filed and controlled as records. Records that are readily available in the open literature need only be referenced. The purpose is to provide a clear, complete record of activities and supporting documents.

7.3.5 The last entry in a technical record book shall be either a statement that the work was concluded or a reference to a sequential technical record book.

7.4 *Content of Technical Record Books*—The following information may be entered in technical record books, as applicable:

7.4.1 Table of Contents, consisting of pages with continuing entries.

7.4.2 What work was done and how it was done, including such information as a description of the facility, test design, measuring and test equipment (by serial number), and a reference by number and title to any standard procedure used.

7.4.3 Instrument numbers or equipment used, if not specified in a referenced procedure.

7.4.4 Field checks or calibrations that are not documented elsewhere.

7.4.5 Identification of personnel and responsibilities or duties of each person.

7.4.6 Why the work was done, including any Statement of Work under which the work was done and with what objective.

7.4.7 What results were obtained. Observations made, the review of the results, and nonconformances and deficiency reports may be included.

7.4.8 Temperature, weather, humidity, wind speed and direction, or other environmental influences that might affect the results.

7.4.9 Documentation of variances from planned activities. A variance is considered to be a deviation from “shall”, “must”, or “will” statements of a procedure.

7.4.10 Location of the activity, including site and sample or test location.

7.4.11 Name and address of field contact.

7.4.12 Sampling entries:

7.4.12.1 Purpose of sampling.

7.4.12.2 Description of sampling point and sampling methodology.

7.4.12.3 Number of samples taken and volume.

7.4.12.4 Date and time of sample collection.

7.4.12.5 Sample destination (name of laboratory) and how transported (hand carried or name of carrier, such as United Parcel Service or Federal Express).

7.4.12.6 References such as maps or photographs of the sampling site.

7.4.13 Entries relating to waste:

7.4.13.1 Producer of waste and address, if different for that location.

7.4.13.2 Type of process (if known) that produced the waste.

7.4.13.3 Type of waste (e.g., sludge, wastewater).

7.4.13.4 Suspected composition and concentrations of waste.

7.4.14 Other appropriate entries such as calculations, problems encountered and actions taken to resolve them, or interfaces with agencies.

*7.5 Review of Technical Record Books*—An independent reviewer will review technical record books for content, accuracy, legibility, calculations, error correction, and reproducibility (see Reference 3.2).

7.5.1 A reviewer will review electronic data collection or data entry for correctness and accuracy by comparison of originals with printed data or by review of the graphic representation of the data.

7.5.2 The reviewer will check for completeness, validity of data, and traceability between each page and the items or activities to which it applies. The reviewer will take action to correct any deficiencies.

7.5.3 When the reviewer is satisfied that the recorded information is complete and correct, the reviewer will sign and date the technical record book and indicate the pages and supporting documents that were reviewed.

7.5.4 Written comments by a reviewer that are clearly identified as review comments will not require review by a second reviewer.

*7.6 Storage of Technical Record Books*—Technical record books shall be stored in fire-resistant metal file cabinets or otherwise protected from damage when not directly in use. Records shall not be left unprotected overnight or on holidays, vacations, or weekends (see Reference 3.2).

## **8. Keywords**

8.1 Data sheets, documentation, field documentation, field notebooks, logbooks, records, and technical records books.

# Standard Practice for Chain-of-Sample-Custody Control and Physical Security of Samples

## 1. Scope

1.1 This procedure describes the documentation required for tracing sample custody and the requirements for maintaining physical security of samples.

1.2 Control, storage, and disposal of samples should be addressed in the Work Plan for a particular project.

## 2. Hazard Analysis

2.1 No hazards requiring controls have been identified. Site-specific controls are available in the Health and Safety Plan for a particular project.

## 3. Referenced Documents

3.1 *GJO Environmental Procedures Catalog* (GJO 6):

Standard Practice for Sample Labeling [GT-2(P)].

## 4. Terminology

4.1 *Chain-of-sample-custody record*-A form such as the Chain of Sample Custody (GJO 1512), or equivalent, used to document sample custody and receipt. GJO 1512, Chain of Sample Custody, is a four-part no-carbon-required (NCR) form available as a contractor Stores issue item (Figure 1).

4.2 *Custody*-To maintain a sample in sight, immediate possession, or locked under one's personal control.

4.3 *Custody seals or tags*-Adhesive-backed strips, or metal or plastic tags, fastened to the sample container or the shipping container in such a way as to demonstrate that no tampering with the sample has occurred. Custody seals also may be manufactured in the field by using paper strips and clear plastic tape.

4.4 *Duplicate samples*-More than one sample collected from the same source location but placed in separate containers. Also called multiple samples.

4.5 *Physical security*-Synonymous with custody but emphasizes the measures taken to prevent tampering with the samples or sampling process.

4.6 *Sample (n)*-A portion of material collected from a larger mass.

4.7 *Sample (v)*-To select and collect a sample.

4.8 *Sample number*-The unique identification number assigned by the Contractor to each sample and attached to, or written on, the sample label or sample container. The sample number will normally consist of three alpha and three numeric characters and will have both eye-readable and bar-code portions. See Standard Practice for Sample Labeling [GT-2(P)], Section 3.1, on how to obtain sample numbers.

4.9 *Split sample*-A sample that has been subdivided into two or more parts, each part representative of the original sample.

## 5. Significance and Use

5.1 All contractor personnel shall use this procedure for chain-of-sample-custody control and physical security unless an approved alternate procedure is included or referenced in the official project records.

5.2 Projects that do not require sample custody documentation may use other types of sample logs for documenting sample information.

<b>Grand Junction Office</b> 2597 B 3/4 Road Grand Junction, Colorado 81503 Telephone (970) 248-6000				<b>Chain-of-Sample Custody</b>				1. Page ____ of ____ 2. Date _____						
3. Project Name _____ 4. Site Location _____				<div style="border: 1px solid black; padding: 2px; display: inline-block;">11. Containers</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="width: 100%; height: 100%; background: linear-gradient(to top right, transparent 49%, black 49%, black 51%, transparent 51%); background-size: 4px 4px;"></div> </div>				5. Sampler (print name) _____						
6. Sample No.	7. Date	8. Time	9. Sample Location	10. Sample Matrix	<div style="border: 1px solid black; padding: 2px; display: inline-block;">11. Containers</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="width: 100%; height: 100%; background: linear-gradient(to top right, transparent 49%, black 49%, black 51%, transparent 51%); background-size: 4px 4px;"></div> </div>				12. Remarks	13. Condition Received				
14. Relinquished by (signature)			Date	Time	Relinquished by (signature)			Date	Time	Relinquished by (signature)			Date	Time
Received by (signature)			Date	Time	Received by (signature)			Date	Time	Received by (signature)			Date	Time
15. Method of Shipment				16. Laboratory/Destination				17. Airbill or Receipt Number						
18. For Contract Laboratories Only—Receiver to sign, date, and return form by mail or with analytical data package Company Name _____ Received by _____ Date _____														

GJO 1512  
 5/97

Preparation instructions on back of form.

Distribution: Original accompanies shipment, copies to relinquisher.

Figure 1. Chain of Sample Custody Form (GJO 1512)

## 6. Materials

6.1 Chain of Sample Custody form (GJO 1512) or equivalent.

6.2 Ballpoint pen with waterproof, reproducible ink.

6.3 Custody seals or tags.

6.4 Clear plastic tape (normally 2 inches wide).

6.5 Padlocks, receptacles, containers, and/or enclosures as appropriate to provide physical security of the samples.

## 7. Chain-of-Sample-Custody Procedure

7.1 The sampler shall complete the chain-of-sample-custody record during or after sample collection. Use the current version of GJO 1512 unless a project specifies a different form or specifies that no chain-of-sample-custody is required.

7.2 Use waterproof, reproducible ink to complete the form.

7.3 The initiator of the form is responsible for legibility of all entries other than signatures.

7.4 General instructions for completing GJO 1512 are printed on the back of the form (Figure 2). The following items provide additional information to the instructions.

7.4.1 The preservation method may be specified in the remarks column.

7.4.2 *Condition Received*-Examples of conditions to note could include broken container, lid off, leaking fluid, etc.

7.4.3 *Relinquished by/Received by*-When the samples are physically transferred from one person to another, or from a person to a shipper, the relinquisher and receiver shall sign the appropriate block, with the date and time of sample transfer. The relinquishers, by signing, verify that the samples have been within their custody.

7.4.3.1 It is each signatory's responsibility to write the signature legibly.

7.4.3.2 The relinquisher retains a copy of the form.

7.4.3.3 Noncontractor employees are not required to sign the form (e.g., employees of shipping companies).

7.5 The following is the minimum information required on the form to ensure sample identification:

7.5.1 Date chain-of-sample-custody form was prepared;

7.5.2 Project name;

7.5.3 Sampler's printed name; and

7.5.4 Sample number.

7.6 Complete all information blocks or label the blocks "NA" for "not applicable." Line through unused portions of items 6 through 13 with a single line, and initial and date the line (Figure 3).

7.7 When samples will be transported by a non-Contractor shipper, use custody seals or tags to seal the individual sample containers or the inner or outer shipping carton.

7.7.1 When seals are applied to the sample container, they must not obscure the information on the sample label.

7.7.2 Securely wrap or fasten shipping containers prior to application of the custody seals. The seals are inherently fragile and will not withstand pressure from an inadequately packaged container. Seal all possible access flaps or lids of the shipping container.

## Chain-of-Sample Custody

1. **Page \_\_\_\_ of \_\_\_\_:** Indicates sequence and total number of pages.
2. **Date:** Date the chain-of-custody record was prepared.
3. **Project Name:** The project name or title.
4. **Site Location:** The location of the project site.
5. **Sampler:** The printed name of the person who collected the samples.
6. **Sample No.:** The unique three-letter, three-digit number generated by GJO.
7. **Date:** Date the sample was collected.
8. **Time:** The time the sample was collected.
9. **Sample Location:** The location at which the sample was taken; e.g., well number, grid location, or survey coordinate.
10. **Sample Matrix:** The sample matrix, e.g., soil, sludge, water, air, or filter.
11. **Container:** The type of container; e.g., write 40-mL glass in the slanted column. Write the number of containers of a given type on the corresponding horizontal line.
12. **Remarks:** Any remarks, as appropriate; preservation method required, e.g., acidified < 2 pH.
13. **Condition Received:** For use by laboratory personnel, to note any damage to sample or container.
14. **Relinquished by/Received by:** Signatures of relinquishers and receivers, with date and time of sample transfer.
15. **Method of Shipment:** The method of shipment, e.g., Federal Express, bus line, etc.
16. **Laboratory/Destination:** The place the samples were shipped for analysis, storage, or other purposes.
17. **Airbill or Receipt Number:** For use with airbills or receipts from contract shippers.
18. **For Use by Contract Laboratories Only:** For use by laboratories other than the Grand Junction Office (GJO). Receiver to sign, date, and return this form to GJO by mail or with analytical data package.

**General:** The purpose of this form is to document sample custody and receipt. GJO assumes no responsibility for samples not in the custody of GJO personnel.

The users of this form are responsible for completing the form by using a waterproof, reproducible ink.

The users of this form are responsible for legibility of all entries.

All information blocks must be completed or marked as "NA" for "Not Applicable." Unused portions of the form must be lined out with a single line, initialed, and dated.

*Figure 2. Instructions for Completing Chain-of-Sample-Custody Form (Reverse Side of GJO 1512)*


**Grand Junction Office**  
2597 B 3/4 Road  
Grand Junction, Colorado 81503  
Telephone (970) 248-6000

**Chain-of-Sample Custody**

1. Page 1 of 1  
2. Date 12/3/98

3. Project Name OU1  
4. Site Location Monticello, UT

5. Sampler (print name) Sam Sampler

6. Sample No.	7. Date	8. Time	9. Sample Location	10. Sample Matrix	11. Containers				12. Remarks	13. Condition Received
					1L Plastic	1.5L Plastic	0.5L Glass	40ml Glass		
NAA 001	12/3/98	1:00 pm	Well 5A	Water	3				Re-226, pH < 2 HNO <sub>3</sub>	OK
I	I	I	I	I	1				metals, pH < 2 HNO <sub>3</sub> Unfiltered	I
					3				PCB, Unfiltered, Cool	
					1				BOD, Cool	
 <u>12/3/98</u>										

14. Relinquished by (signature) <u>Sam Sampler</u>		Date <u>12/3/98</u>	Time <u>1:30 p</u>	Relinquished by (signature)		Date	Time	Relinquished by (signature)		Date	Time
Received by (signature) <u>Roger Receipt</u>		Date <u>12/3/98</u>	Time <u>1:30 p</u>	Received by (signature)		Date	Time	Received by (signature)		Date	Time

15. Method of Shipment \_\_\_\_\_ 16. Laboratory/Destination \_\_\_\_\_ 17. Airbill or Receipt Number \_\_\_\_\_

18. For Contract Laboratories Only—Receiver to sign, date, and return form by mail or with analytical data package

Company Name \_\_\_\_\_ Received by \_\_\_\_\_ Date \_\_\_\_\_

GJO 1512  
5/97

Preparation instructions on back of form.

Distribution: Original accompanies shipment, copies to relinquisher.

Figure 3. Example of Completed Chain-of-Sample-Custody Form

7.7.3 Enter the date the samples are sealed and sign the custody seals or tags as shown below. Clear plastic tape may be applied over the seals for protection.

<b>CUSTODY SEAL</b>	
Date	_____
Signature	_____

*Example of Custody Seal*

7.8 The original chain-of-sample-custody record shall accompany the samples until they are received by the laboratory.

7.9 Unless otherwise specified by the project, the chain-of-sample-custody record shall be maintained as part of the project records.

## **8. Physical Security of Samples and Sampling Process**

8.1 The sampler must maintain physical security of the samples, sampling process, and equipment by physical possession, visual contact, or seals or locks to prevent tampering. Because the procedures for physical security are unique to each sampling situation, only guidelines can be given.

8.1.1 Lock the sampling device when unattended. For example, when using an unattended autosampler to collect samples for a period of time, the device must be locked or secured to maintain physical security.

8.1.2 Store samples in a locked storage area. For example, when collecting samples for a period of time before transporting to the laboratory, lock the samples in a secure storage area or in an area with controlled access such as a locked vehicle or locked field office.

8.1.3 Use security seals where appropriate. Although security seals do not provide physical security, the seals are evidence that the samples or sampling process was not tampered with while unattended.

8.1.4 Use best professional judgment when providing physical security of the samples or sampling process. The sampler should be knowledgeable of the programmatic requirements for the samples and provide the appropriate degree of physical security.

8.2 Document in field logs, or other project documents, the type of physical security used.

## **9. Keywords**

9.1 Chain-of-sample-custody record, form, laboratory, physical security, samples, and shipper.

# Standard Test Method for Exterior Radon Measurements Using Alpha-Track Monitors

## 1. Scope

1.1 This test method provides guidelines to determine the estimated exterior atmospheric radon concentration using alpha-track monitors. Included in this test method are procedures for ordering, storing, placing, retrieving, and shipping monitors; and for exposing control monitors.

## 2. Hazard Analysis

2.1 Safety shoes and safety glasses shall be worn while installing steel posts at the sampling locations.

2.2 No other hazards requiring controls have been identified. Site-specific controls may be available in the Health and Safety Plan for a particular project.

## 3. Referenced Documents

### 3.1 *Code of Federal Regulations*:

40 CFR 192, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings.

3.2 Rangel, M. J., M. D. Pearson, and G. H. Langner, Jr., "Radon-Free Chamber" in *Abstracts of Papers Presented at Thirty-Third Annual Meeting of the Health Physics Society*, Boston, MA, July 4–8, 1988, Pergamon Press, New York, NY, 1988.

## 4. Terminology

4.1 *Alpha-track radon monitor*—A monitor consisting of a plastic alpha-track registration material enclosed in a filtered container. Alpha particles from radon and its decay products produce damage tracks on this material. The passive monitor continually accumulates these damage tracks during a defined period of exposure. The density of the tracks is proportional to the radon exposure.

4.2 *Blank*—An alpha-track radon monitor left unexposed (placed in a radon-free chamber) as part of the quality control process.

4.3 *Control monitors*—Monitors randomly selected from each batch of monitors ordered that are used to assess errors introduced by the manufacturing, handling, and processing steps. Positive controls are monitors that have been exposed to a known radon concentration in a radon chamber. Negative controls are blank monitors that have received no radon exposure beyond that accumulated in the manufacturing, shipping, and analytical processes.

4.4 *Integrating monitor*—An instrument designed to estimate the cumulative exposure to radon or radon decay products in an atmosphere.

## 5. Significance and Use

5.1 Atmospheric concentrations of radon-222 (Rn-222) are monitored in the vicinity of uranium mill tailings to demonstrate compliance with the U.S. Environmental Protection Agency (EPA) Rn-222 emission standard (reference 3.1), and to provide a database for assessing exposures to the general public. Alpha-track radon monitors are one type of device used to measure atmospheric Rn-222. Exterior radon measurements also are used for routine environmental monitoring.

## 6. Interferences

6.1 The alpha-track registering material is sensitive to alpha particles from any source. However, the alpha-track radon monitor is calibrated only for exposure to Rn-222. It is important to inspect the filter before and after exposure because a damaged filter can allow radon decay products and other radionuclides to enter the monitor. Most commercial filters do not eliminate short-lived gaseous alpha emitters like thoron. However, because of thoron's short half-life (55.6 seconds) and associated short migration distance, it is generally considered an inconsequential constituent of air that is more than several centimeters above ground level.

6.2 Because the monitors are integrating devices, care must be taken to prevent exposing monitors to radon during storage. Any radon entering the monitors before or after the scheduled exposure will produce tracks that are indistinguishable from tracks registered during the exposure. For this reason, a radon-free storage chamber was developed (reference 3.3). The radon-free chamber consists of a barrel with an annular volume filled with activated charcoal to absorb radon within the barrel. Alpha-track monitors shall be kept in a radon-free chamber except while exposing, shipping, and handling.

## **7. Apparatus**

7.1 Exterior alpha-track radon monitors and various accessories needed to assemble the monitors.

7.2 Environmental enclosures.

7.3 Field notebook.

7.4 Fence post driver.

7.5 Site map.

7.6 Steel T-posts, 5 feet in length.

7.7 Steel hose clamps.

7.8 Screwdriver.

7.9 Personal protective equipment (e.g., safety glasses and safety shoes).

7.10 Radon-free storage chamber, or equivalent.

## **8. Procedure for Ordering and Storing Monitors**

8.1 If the manufacturer offers this service, reserve enough alpha-track registration material from a single batch to supply the estimated program needs for 1 year and place small orders, as needed. This procedure will eliminate the uncertainty introduced by batch-to-batch sensitivity variations in the alpha-track registration material.

8.2 Upon receipt from the vendor, check the wrapping material of each monitor for damage. Do not accept monitors in damaged packages. Record drum number, monitor type, program name, date received, and serial number of all accepted monitors on the Monitor Log Sheet (Figure 1). This also may be accomplished by using a database. Store all accepted monitors in a radon-free chamber to reduce exposure to radon.

## **9. Procedure for Placing Monitors**

9.1 The number of monitors placed, the frequency of replacement, the location and quantity of sampling locations (including background sampling locations), and the need for consent for access forms will be determined on a site-specific basis.

9.2 Remove the needed monitors from the radon-free chamber. Add the date removed to the Monitor Log Sheet or database.

9.3 When selecting sampling locations, consider prevailing wind patterns, population distributions, and previous atmospheric radon measurements. Select sampling locations that minimize the risk of damage to the monitors from traffic and vandalism. When possible, establish one of the background sampling locations in an area that is unpopulated, upwind from the site, away from effects of industrial atmospheric pollution, and representative of the local geology.

9.4 At the sampling location, drive a 5-foot steel T-post into the ground using a fence post driver.

9.5 Record the sampling location and location number on a map of the site.

9.6 Remove the alpha-track radon monitor from the sealed wrapping material. Place the monitor the same day its sealed wrapper is opened.

9.7 Inspect the monitor. Do not use any monitor with a filter that is cracked, torn, or separated from the edge of the monitor.

Drum No.	Monitor Type	Program	Date In	Serial No.	Date Out
580	Radtrak	MRAP	04/08/92	3557810	
580	Radtrak	MRAP	04/08/92	3557802	
580	Radtrak	MRAP	04/08/92	3557803	
580	Radtrak	MRAP	04/08/92	3557804	
580	Radtrak	MRAP	04/08/92	3557805	
580	Radtrak	MRAP	04/08/92	3557806	
580	Radtrak	MRAP	04/08/92	3557807	
580	Radtrak	MRAP	04/08/92	3557808	
580	Radtrak	MRAP	04/08/92	3557809	
580	Radtrak	MRAP	04/08/92	3557810	
580	Radtrak	MRAP	04/08/92	3557811	
580	Radtrak	MRAP	04/08/92	3557812	
580	Radtrak	MRAP	04/08/92	3557813	
580	Radtrak	MRAP	04/08/92	3557814	
580	Radtrak	MRAP	04/08/92	3557815	
580	Radtrak	MRAP	04/08/92	3557817	
580	Radtrak	MRAP	04/08/92	3557818	
580	Radtrak	MRAP	04/08/92	3557821	
580	Radtrak	MRAP	04/08/92	3557822	
580	Radtrak	MRAP	04/08/92	3557823	
580	Radtrak	MRAP	04/08/92	3557826	
580	Radtrak	MRAP	04/08/92	3557827	
580	Radtrak	MRAP	04/08/92	3557828	
580	Radtrak	MRAP	04/08/92	3557830	
580	Radtrak	MRAP	04/08/92	3557831	
580	Radtrak	MRAP	04/08/92	3557832	
580	Radtrak	MRAP	04/08/92	3557834	
580	Radtrak	MRAP	04/08/92	3557835	
580	Radtrak	MRAP	04/08/92	3557836	
580	Radtrak	MRAP	04/08/92	3557837	
580	Radtrak	MRAP	04/08/92	3557838	
580	Radtrak	MRAP	04/08/92	3557839	
580	Radtrak	MRAP	04/08/92	3557840	

Figure 1. Example of Monitor Log Sheet for Radon-Free Chamber

9.8 Compare the serial number on the monitor with the number on the package. If necessary, use permanent ink to correct the number on the package so that it agrees with the number on the monitor. Save the package.

9.9 Place any accessories on the monitor according to the instructions supplied by the vendor.

9.10 Record the monitor's serial number, date of installation, and sampling location in the field notebook.

9.11 Place the monitors in a protective environmental enclosure. Environmental enclosures can be fabricated using 3-inch polyvinyl chloride (PVC) caps, 3-inch PVC pipe, and 1/4-inch wire screen (Figure 2). The interior of the environmental enclosures may vary

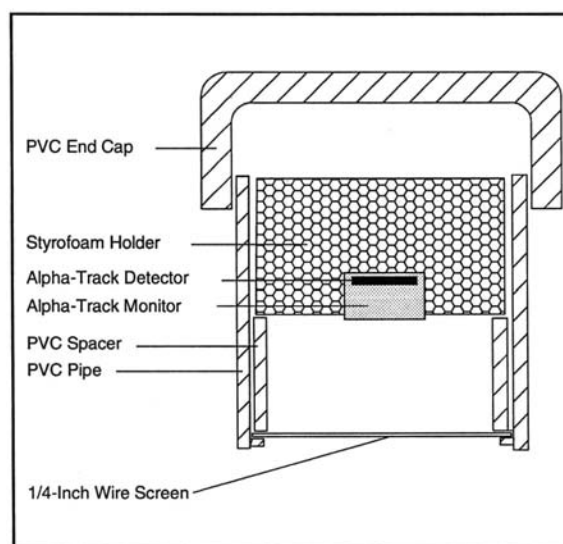


Figure 2. Cross-Sectional View of Environmental Enclosure Holding Alpha-Track Radon Monitor

depending on the geometry of the alpha-track radon monitor used.

9.11.1 Remove the PVC cap and Styrofoam holder from the environmental enclosure.

9.11.2 Place the alpha-track radon monitor inside the Styrofoam holder so the filtered surface of the monitor is visible (see Figure 2).

9.11.3 Replace the Styrofoam in the enclosure with the alpha-track radon monitor facing the screen.

9.11.4 Push the PVC cap over the enclosure.

9.12 Secure the environmental enclosure containing the alpha-track radon monitor to the T-post with a steel hose clamp at 1 meter above ground level with the open side facing down. This step may vary according to the type of monitor and the vendor's instructions.

9.13 Place monitors in duplicate (to improve precision) at all sampling locations for a period of at least 3 months.

9.14 Repeat steps 9.4 through 9.13 for all sampling locations. Sign and date the bottom of each page of the field notebook where new entries were made.

## **10. Procedure for Retrieving Monitors**

10.1 Remove the steel hose clamp that holds the environmental enclosure to the steel T-post.

10.2 Remove the PVC cap from the enclosure.

10.3 Remove the alpha-track radon monitor from the Styrofoam holder. Inspect the monitor for damage. Note its condition in the field notebook.

10.4 Record the retrieval date in the field notebook and verify that the monitor's serial number and the sampling location are correct.

10.5 Remove and discard any disposable accessories.

10.6 Seal and/or pack the monitor as recommended by the vendor.

10.7 Install a replacement monitor according to section 9 if monitoring is to be continued.

10.7.1 If monitoring is complete, remove the environmental enclosure and T-post from the sampling location.

10.8 Repeat steps 10.1 through 10.7 for all sampling locations. Sign and date the bottom of each page of the field notebook where new entries were made.

10.9 Store all exposed monitors in a radon-free chamber until they are shipped to the vendor.

## **11. Procedure for Shipping Monitors**

11.1 Collect all field and control monitors from the radon-free chamber. Add the date removed to the Monitor Log Sheet or database.

11.2 Package the monitors according to the vendor's instructions.

11.3 Prepare a data information sheet using data from the field notebook, showing only the monitor's serial number, the date installed, and the date retrieved (Figure 3). Include fictitious dates for the control monitors to approximate the dates of the field monitors. Prepare additional copies of the data information sheet including location information (Figure 4) for the customer.

11.4 Complete the appropriate procurement paperwork. Have the monitors analyzed at the vendor's most precise level of sensitivity. The following values must be requested from the vendor: total tracks counted, average net tracks per square millimeter, net radon exposure in picocurie days per liter, average radon concentration in picocuries per liter, and calibration factor or batch number used.

11.5 Ship monitors by an express service.

Serial Number	Date Installed	Date Retrieved
3176738	3/26/91	6/24/91
3176739	3/26/91	6/24/91
3176740	3/26/91	6/24/91
3176741	3/26/91	6/24/91
3176742	3/26/91	6/24/91
3176743	3/26/91	6/24/91
3176744	3/26/91	6/24/91
3176745	3/26/91	6/24/91
3176746	3/26/91	6/24/91
3176747	3/26/91	6/24/91
3176748	3/26/91	6/24/91
3176749	3/26/91	6/24/91
3176750	3/26/91	6/24/91
3176751	3/27/91	6/25/91
3176752	3/27/91	6/25/91
3176753	3/27/91	6/25/91
3176754	3/27/91	6/25/91
3176755	3/27/91	6/25/91
3176756	3/27/91	6/25/91
3176757	3/27/91	6/25/91

*Figure 3. Example of Data Information Sheet for Shipment*

## 12. Calculation

12.1 Use the vendor's reported values for control.

12.2 To adjust the vendor's reported values, calculate the radon activity concentration, in picocuries per liter, as follows:

$$\text{average radon concentration} = \frac{\text{net track density}}{(Y)(T)}$$

where

net track density = total number of tracks per square millimeter of the alpha-particle-sensitive material minus the average background track density determined from the negative control monitors;

$Y$  = yield factor for the monitor as determined from calibration exposures in tracks per square millimeter per picocurie days per liter; and

$T$  = total time of the exposure in days.

Serial Number	Date Installed	Date Retrieved	Location
3176738	3/26/91	6/24/91	Blank
3176739	3/26/91	6/24/91	Station 1
3176740	3/26/91	6/24/91	Control
3176741	3/26/91	6/24/91	Station 3
3176742	3/26/91	6/24/91	Station 4
3176743	3/26/91	6/24/91	Control
3176744	3/26/91	6/24/91	Blank
3176745	3/26/91	6/24/91	Station 4
3176746	3/26/91	6/24/91	Station 1
3176747	3/26/91	6/24/91	Station 5
3176748	3/26/91	6/24/91	Control
3176749	3/26/91	6/24/91	Station 3
3176750	3/26/91	6/24/91	Station 2
3176751	3/27/91	6/25/91	Station 5
3176752	3/27/91	6/25/91	Station 6
3176753	3/27/91	6/25/91	Control
3176754	3/27/91	6/25/91	Station 2
3176755	3/27/91	6/25/91	Control
3176756	3/27/91	6/25/91	Control
3176757	3/27/91	6/25/91	Station 6

Figure 4. Example of Data Information Sheet for Customer

### 13. Documentation and Records

13.1 Keep copies of the vendor's report, any calculations, data information sheets, and data from exposure of control monitors in the file.

13.2 Send originals of the vendor's report, calculations, customer data information sheets, consent forms (if applicable), Monitor Log Sheet (Figure 1), and completed field notebooks to the principal investigator for inclusion in the project file.

### 14. Precision and Bias

14.1 The precision of the mean of the alpha-track measurements can be estimated from the results

of the concurrently exposed field monitors. The best estimate of the precision is obtained from the standard error of the mean (SE):

$$SE = \frac{1.253s}{\sqrt{11}}$$

where

$s$  = sample standard deviation; and  
 $n$  = number of concurrently exposed monitors (i.e., 2).

14.1.1 The fractional precision is then obtained by dividing the standard error of the mean by the sample mean ( $\bar{x}$ ).

14.1.2 The sample mean and the sample standard deviation are calculated using the results reported by the vendor for the monitors exposed at one sampling location.

14.2 The fractional bias of the alpha-track measurements can be estimated from the results of the positive control monitors as follows:

$$\text{fractional bias} = \frac{(\bar{x} - R)}{R}$$

where

$\bar{x}$  = sample mean of the exposure values reported by the vendor for the positive control monitors in picocurie days per liter; and

$R$  = true value of the exposure in picocurie days per liter obtained from the radon chamber records.

## 15. Keywords

15.1 Alpha-track monitor, atmospheric radon, blank, and control monitor.

End of current text